NINTH YEAR OF SERVICE TO THE METAL WORKING INDUSTRY

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THE IRON AGE

UCTION -:- MANAGEMENT DECEMBER 28, 1933 PROCESSES -:- NEWS

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UNDER the caption "All Of The Cards On The Table" The Iron Age recently published, on this page, facts concerning 39 reader-interest investigations conducted by advertisers among their own customers.

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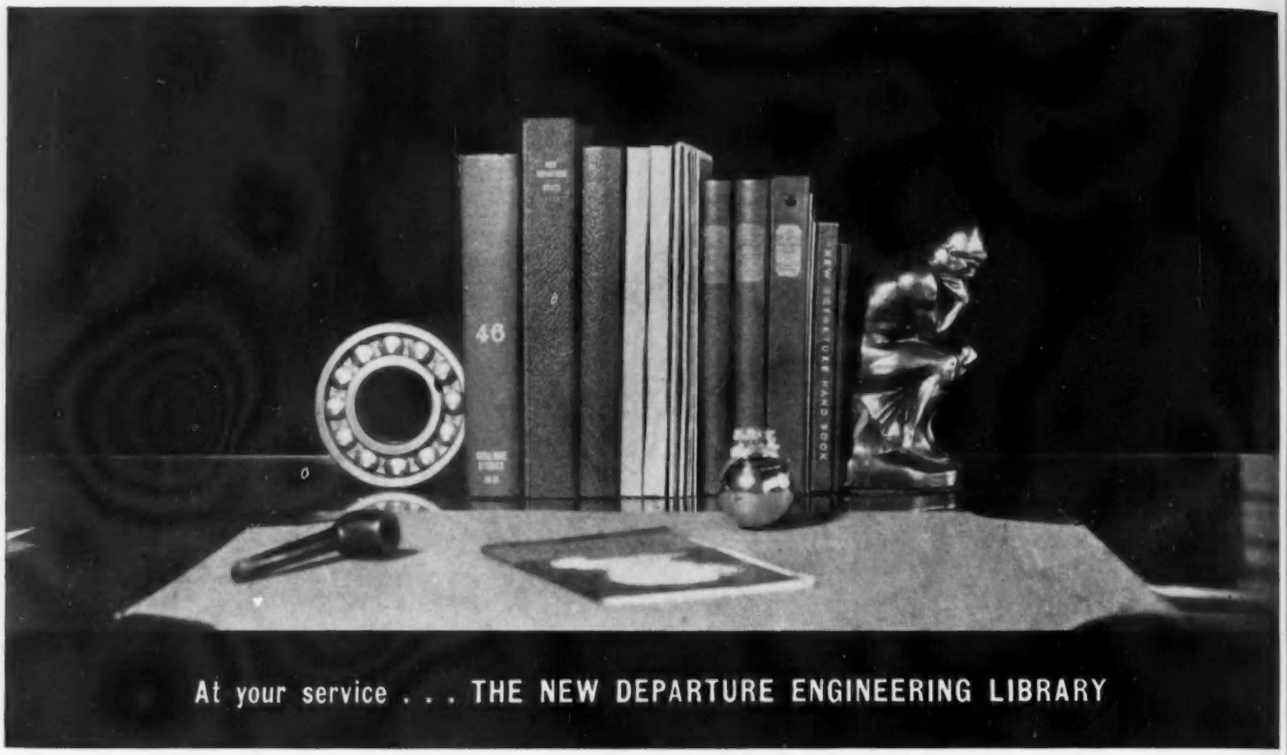

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THE IRON AGE — December 28, 1933

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DECEMBER 28, 1933

ESTABLISHED 1855

Vol. 132, No. 26

Upper Critical Temperature (Ac_3) of Steel as Affected by Various Elements

By. LT. COL. ROBERT R. ABBOTT
Metallurgical Engineer, White Motor Co.

ALL heat treaters must of necessity know the upper critical temperatures of steels in order to secure optimum physical properties upon quenching. The higher the quenching temperature above Ac_3 the more coarsely crystalline will be the resulting steel, and the finest possible structure follows from quenching as close to Ac_3 as possible.

With the usual routine chemical analysis of a steel at hand, a treater can now quickly determine the quenching temperature by using the equations developed in this article, or by employing the simplified and self-contained tables on the accompanying insert.

The small shop should profit from this information, for by the elimination of the guessing factor, it will be possible to produce a superior and more uniform product. This work, presented Dec. 11 at a joint meeting of the Cleveland chapter of the American Society for Steel Treating and the Cleveland section of the Society of Automotive Engineers, represents the most pretentious effort of its kind, and probably transcends the corresponding determination of the effect of impurities on the position of Ac_1 and Ar, by Howe, Osmond, and others.

▼▼▼

TO PROCURE the most efficient heat treatment of steel, it is extremely important that the upper critical temperature be known within narrow limits. It is of industrial importance that, by a chemical analysis, the critical point (Ac_3) can be determined. The following report gives complete data regarding the elevation or depression of the upper critical point as a result of usual additions to steel of carbon, phosphorus, sulphur, chromium, manganese, nickel or silicon.

For the investigation, approximately 400 bars of steel were obtained from various manufacturers in the United States and foreign countries. These were, so far as possible, obtained annealed in ¾-in. diameter sizes. In all cases the annealing was repeated. The samples included all varieties of steels obtainable, and each variety group contained samples with various carbon contents.

Samples from each bar were examined microscopically for segregation, and, if this was found in more than normal amounts, the bar was discarded. Drillings were taken from each end, and exhaustive chemical analyses were made for all possible elements. If excessive differences were found in the two ends, the bar was discarded. By means of a differential pyrometer, heating curves were made on each steel, and the upper critical point determined within about 10 deg. C. A 10-in. section was then taken from each bar and machined down to ½ in. in diameter and notched with 16 sections. The notching facilitated breaking off of sections at various points throughout the experiment.

Accurately Annealed in Lead

The notched bars were all thoroughly annealed by very slow cooling in lead until a microscopic examination of the samples showed good pearlite structure well separated from the ferrite. The lead annealing pot contained about two tons of lead, and was fitted with a platinum resistance pyrometer accurate to within less than 1 deg. C. over a range of 200 deg. C.

The notched bars were grouped in accordance with their upper critical points and placed in the furnace, which was heated at a rate of about 2 C. deg. an hour. At a temperature 10 deg. below the critical point, as determined previously with the differential pyrometer, the bar was drawn from the lead, quenched in water, and one section broken or sawed off. It was then replaced and another section removed at 5 deg. below, another near the assumed crit-

ical point, and others at 5 deg. and 10 deg. above the assumed critical point. These five quenched buttons were examined under the microscope, thereby finding the last absorption of ferrite within a 5 deg. range, or, in other words, established the Ac_3 point to within 5 C. deg.

After this determination was made the same process was repeated within the narrowed limit of 5 deg., and six buttons were quenched 1 deg. apart, and by microscopic examinations the Ac_3 point was determined to within 1 C. deg.

Effect of Various Elements

In order to find the effect of different elements upon Ac_3, the mass of experimental data had to be analyzed by the method of least squares, because of the number of variables and size of figures involved. Only the results are of value; therefore no attempt will be made to portray the mathematical complexities leading to the final solutions.

A preliminary determination was made of the effect of carbon on Ac_3, using 36 plain carbon steels of various carbon contents, and ignoring the effect of sulphur, manganese, silicon and phosphorus.

The experimental data reduced mathematically to

$$(1)\quad T=903-2.30\ C$$

where T is the centigrade temperature of Ac_3, and C the carbon content expressed in hundredths of a per cent.

For the preliminary determination of the effect of manganese upon Ac_3, 34 carbon steels were used containing only normal amounts of silicon, phosphorus, and sulphur. These steels were selected with a fairly narrow carbon range (0.14 to 0.34 per cent), but with a manganese range from 0.17 to 1.61 per cent.

When the effect of the carbon Ac_3 depression is mathematically eliminated, the manganese equation is found to be

$$(2)\quad T=903-0.2725\ Mn$$

The preliminary determination therefore indicates that 0.01 per cent manganese lowers the Ac_3 point 0.2725 C. deg. No corrections have been made for phosphorus, sulphur or silicon in these steels, and, therefore, these equations are merely a step toward the final solutions.

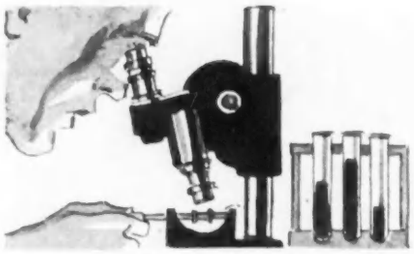
Following the same experimental and mathematical procedure, the following additional preliminary equations were found:

$$(3)\quad T=902+0.4282\ P$$

where phosphorus is expressed in 1/1000 of a per cent; the equation indicates that 0.001 per cent phosphorus raises the Ac_3 point 0.4282 C. deg.

$$(4)\quad T=910+0.3705\ Si$$

where silicon is expressed in 1/100 of a per cent; the equation indicates that



0.01 per cent silicon raises the Ac_3 point 0.3705 C. deg.

The preliminary examinations of the effect of manganese, phosphorus, and silicon upon the upper critical point, and the mathematical equations are so far determined. *Extensive sulphur determinations show its effect to be negligible upon Ac_3, and it is consequently omitted from further calculations.*

Since correction factors for phosphorus and silicon are now available, a more accurate determination of equation (2) can be made by using Ac_3 temperatures corrected for phosphorus and silicon in accordance with equations (3) and (4).

The result is

$$(5)\quad T=898-0.3508\ Mn$$

(compare with equation 2)

Using equations (3) and (5) on 35 steels, a second and more accurate value of the influence of phosphorus is obtained. It is

$$(6)\quad T=906+0.4506\ P$$

Correcting for manganese and phosphorus according to formulae (5) and (6), it is found that

$$(7)\quad T=912+0.3570\ Si$$

A third determination of the effect of manganese after correcting for phosphorus and silicon according to (6) and (7) gives practically the same results as given in equation (5), and, therefore, equations (5), (6) and (7) will be used as representing the effect of manganese, phosphorus and silicon on the Ac_3 point of carbon steels.

Correction Factors Determined

Three correction factors for the effect of manganese, phosphorus and silicon upon the Ac_3 temperature are now usable. These are as follows, from (5), (6) and (7):

0.01 per cent manganese *lowers* Ac_3 by 0.3508 C. deg.

0.001 per cent phosphorus *raises* Ac_3 by 0.4506 C. deg.

0.01 per cent silicon *raises* Ac_3 by 0.3570 C. deg.

These are not final figures, but will be used to correct for the determination of the effects of chrome, nickel, and vanadium. The reason these are not taken as final is that they were determined only from plain carbon steels, and later many alloy steels will be included to obtain more general (and accurate) influences.

Careful comparisons of the Ac_3 corrected temperatures of various steels with widely varying amounts of chromium definitely showed that this element has no appreciable effect upon the Ac_3 temperature.

The Ac_3 temperatures of 31 chrome-vanadium steels were corrected for manganese, phosphorus and silicon, and the effect of vanadium was determined. The result can be expressed as

(8) 0.01 per cent vanadium *raises* Ac_3 0.2862 C. deg.

This vanadium correction is an average. A great deal of work done upon it, however, indicates that vanadium usually occurs in small quantities in most steels, and the above value can be satisfactorily used for all steels with carbon contents below 0.54 per cent.

In all the preceding work no distinction was made (or found, except as noted for vanadium) in low or high-carbon steels up to 0.54 per cent carbon. When nickel steels were examined, however, it was found that the effect was different, and consisted of two parts. The nickel determinations were consequently made in two sections and the final result was,

(9) 0.01 per cent nickel lowers Ac_3 0.23 C. deg.

If the steel has a carbon content *above* that given by the equation $C = 0.54 - 0.0006\ Ni$, subtract 2 C. deg. for each 0.01 per cent of carbon above that shown by the equation. For example, a 3.50 per cent Ni steel is first tested by $C = 0.54 - 0.0006\ Ni$. This gives carbon as 0.33 per cent. If the steel has less than 0.33 carbon content, the correction applied is that of equation (9), but if it has *more* than 0.33 per cent carbon, *subtract* from this correction 2 deg. for each point the carbon is above 0.33 per cent.

Final Solutions

All the correction factors are now finished, and the basic effect of carbon on pure iron must be determined to give a point from which to start. About 236 steels were used for this, and their Ac_3 temperatures were corrected for all the affecting elements present, and the final equation for pure carbon-iron alloys was found to be

$$(10)\quad T=908-2.237\ C.$$

where carbon is expressed in hundredths of a per cent.

When carbon is 0, $T = 908$. This means that the Ac_3 point for the first trace of carbon is at 908 deg. C. This gives a basis to make a more accurate determination of the influence of the various elements given in the previous equations, since it can be assumed that 908 deg. C. is the fixed point for pure iron. All of the preceding determina-

Determination of Upper Critical Point From Che

TABLE I

Carbon In 1/100 per cent	Basic Temp. Deg. C.
0	908
1	906
2	904
3	901
4	899
5	897
6	895
7	892
8	890
9	888
10	886
11	883
12	881
13	879
14	877
15	874
16	872
17	870
18	868
19	866
20	863
21	861
22	859
23	857
24	854
25	852
26	850
27	848
28	845
29	843
30	841
31	839
32	836
33	834
34	832
35	830
36	827
37	825
38	823
39	821
40	819
41	816
42	814
43	812
44	810
45	807
46	805
47	803
48	801
49	798
50	796
51	794
52	792
53	789
54	787

TABLE II

C. Deg. Correction	Phosphorus In 1/1000 (Add)	Silicon In 1/100 (Add)	Vanadium In 1/100 (Add)	Manganese In 1/100 (Subtract)
0	1	1	1	1
1	2 – 3	2 – 4	2 – 3	2 – 4
2	4 – 5	5 – 8	4 – 6	5 – 7
3	6 – 7	9 – 11	7 – 9	8 – 10
4	8 – 10	12 – 14	10 – 11	11 – 13
5	11 – 12	15 – 18	12 – 14	14 – 15
6	13 – 14	19 – 21	15 – 17	16 – 18
7	15 – 17	22 – 24	18 – 19	19 – 21
8	18 – 19	25 – 27	20 – 22	22 – 24
9	20 – 21	28 – 31	23 – 25	25 – 27
10	22 – 23	32 – 34	26 – 27	28 – 30
11	24 – 26	35 – 37	28 – 30	31 – 33
12	27 – 28	38 – 40	31 – 32	34 – 36
13	29 – 30	41 – 44	33 – 35	37 – 39
14	31 – 33	45 – 47	36 – 38	40 – 42
15	34 – 35	48 – 50	39 – 40	43 – 45
16	36 – 37	51 – 54	41 – 43	46 – 47
17	38 – 39	55 – 57	44 – 46	48 – 50
18	40 – 42	58 – 60	47 – 48	51 – 53
19	43 – 44	61 – 63	49 – 51	54 – 56
20	45 – 46	64 – 67	52 – 54	57 – 59
21	47 – 49	68 – 70	55 – 56	60 – 62
22	50 – 51	71 – 73	57 – 59	63 – 65
23	52 – 53	74 – 77	60 – 61	66 – 68
24	54 – 55	78 – 80	62 – 64	69 – 71
25	56 – 58	81 – 83	65 – 67	72 – 74
26	59 – 60	84 – 86	68 – 69	75 – 76
27	61 – 62	87 – 90	70 – 72	77 – 79
28	63 – 64	91 – 93	73 – 75	80 – 82
29	65 – 67	94 – 96	76 – 77	83 – 85
30	68 – 69	97 – 100	78 – 80	86 – 88
31	70 – 71	101 – 103		89 – 91
32	72 – 74	104 – 106		92 – 94
33	75 – 76	107 – 109		95 – 97
34	77 – 78	110 – 113		98 – 100
35	79 – 80	114 – 116		102 – 104
36	81 – 83	117 – 119		105 – 107
37	84 – 85	120 – 123		108 – 109
38	86 – 87	124 – 126		110 – 111
39	88 – 90	127 – 129		112 – 114
40	91 – 92	130 – 132		115 – 117
41	93 – 94	133 – 136		118 – 120
42	95 – 96	137 – 139		121 – 123
43	97 – 99	140 – 142		124 – 126
44	100 – 101	143 – 145		127 – 129
45	102 – 103	146 – 149		130 – 132
46	104 – 106	150 – 152		133 – 135
47	107 – 108	153 – 155		136 – 137
48	109 – 110	156 – 159		138 – 140
49	111 – 112	160 – 162		141 – 143
50	113 – 115	163 – 165		144 – 146
51	116 – 117	166 – 168		147 – 149
52	118 – 119	169 – 172		150 – 152
53	120 – 122	173 – 175		153 – 155
54	123 – 124	176 – 178		156 – 158
55	125 – 126	179 – 182		159 – 161
56	127 – 128	183 – 185		162 – 164
57	129 – 131	186 – 188		165 – 167
58	132 – 133	189 – 191		168 – 169
59	134 – 135	192 – 195		170 – 172
60	136 – 137	196 – 198		173 – 175
61	138 – 140	199 – 201		176 – 178
62	141 – 142			
63	143 – 144			
64	145 – 147			
65	148 – 149			
66	150 – 151			
67	152 – 153			
68	154 – 156			
69	157 – 158			
70	159 – 160			

TABLE III

C. Deg. Correction	Nickel In 1/1 (Subtract)
0	1 – 2
1	3 – 6
2	7 – 10
3	11 – 15
4	16 – 19
5	20 – 23
6	24 – 28
7	29 – 32
8	33 – 36
9	37 – 41
10	42 – 45
11	46 – 49
12	50 – 54
13	55 – 58
14	59 – 63
15	64 – 67
16	68 – 71
17	72 – 76
18	77 – 80
19	81 – 84
20	85 – 89
21	90 – 93
22	94 – 97
23	98 – 102
24	103 – 106
25	107 – 110
26	111 – 115
27	116 – 119
28	120 – 123
29	124 – 128
30	129 – 132
31	133 – 136
32	137 – 141
33	142 – 145
34	146 – 149
35	150 – 154
36	155 – 158
37	159 – 163
38	164 – 167
39	168 – 171
40	172 – 176
41	177 – 180
42	181 – 184
43	185 – 189
44	190 – 193
45	194 – 197
46	198 – 202
47	203 – 206
48	207 – 210
49	211 – 215
50	216 – 219
51	220 – 223
52	224 – 228
53	229 – 232
54	233 – 236
55	237 – 241
56	242 – 245
57	246 – 249
58	250 – 254
59	255 – 258
60	259 – 263
61	264 – 267
62	268 – 271
63	272 – 276
64	277 – 280
65	281 – 284
66	285 – 289
67	290 – 293
68	294 – 297
69	298 – 302
70	303 – 306
71	307 – 310
72	311 – 315
73	316 – 319
74	320 – 323
75	324 – 328
76	329 – 332
77	333 – 336
78	337 – 341
79	342 – 345
80	346 – 349
81	350 – 354
82	355 – 358
83	359 – 363
84	364 – 367
85	368 – 371
86	372 – 376
87	377 – 380
88	381 – 384
89	385 – 389
90	390 – 393
91	394 – 397
92	398 – 402
93	403 – 406

ritical Point From Chemical Analysis

anganese n 1/100 ubtract)	TABLE III C. Deg. Correction	Nickel In 1/100 (Subtract)
1	0	1 - 2
2 - 4	1	3 - 6
5 - 7	2	7 - 10
8 - 10	3	11 - 15
11 - 13	4	16 - 19
14 - 15	5	20 - 23
16 - 18	6	24 - 28
19 - 21	7	29 - 32
22 - 24	8	33 - 36
25 - 27	9	37 - 41
28 - 30	10	42 - 45
31 - 33	11	46 - 49
34 - 36	12	50 - 54
37 - 39	13	55 - 58
40 - 42	14	59 - 63
43 - 45	15	64 - 67
46 - 47	16	68 - 71
48 - 50	17	72 - 76
51 - 53	18	77 - 80
54 - 56	19	81 - 84
57 - 59	20	85 - 89
60 - 62	21	90 - 93
63 - 65	22	94 - 97
66 - 68	23	98 - 102
69 - 71	24	103 - 106
72 - 74	25	107 - 110
75 - 76	26	111 - 115
77 - 79	27	116 - 119
80 - 82	28	120 - 123
83 - 85	29	124 - 128
86 - 88	30	129 - 132
89 - 91	31	133 - 136
92 - 94	32	137 - 141
95 - 97	33	142 - 145
98 - 100	34	146 - 149
02 - 104	35	150 - 154
05 - 107	36	155 - 158
08 - 109	37	159 - 163
10 - 111	38	164 - 167
12 - 114	39	168 - 171
15 - 117	40	172 - 176
18 - 120	41	177 - 180
21 - 123	42	181 - 184
24 - 126	43	185 - 189
27 - 129	44	190 - 193
30 - 132	45	194 - 197
33 - 135	46	198 - 202
36 - 137	47	203 - 206
38 - 140	48	207 - 210
41 - 143	49	211 - 215
44 - 146	50	216 - 219
47 - 149	51	220 - 223
50 - 152	52	224 - 228
53 - 155	53	229 - 232
56 - 158	54	233 - 236
59 - 161	55	237 - 241
62 - 164	56	242 - 245
65 - 167	57	246 - 249
68 - 169	58	250 - 254
70 - 172	59	255 - 258
73 - 175	60	259 - 263
76 - 178	61	264 - 267
	62	268 - 271
	63	272 - 276
	64	277 - 280
	65	281 - 284
	66	285 - 289
	67	290 - 293
	68	294 - 297
	69	298 - 302
	70	303 - 306
	71	307 - 310
	72	311 - 315
	73	316 - 319
	74	320 - 323
	75	324 - 328
	76	329 - 332
	77	333 - 336
	78	337 - 341
	79	342 - 345
	80	346 - 349
	81	350 - 354
	82	355 - 358
	83	359 - 363
	84	364 - 367
	85	368 - 371
	86	372 - 376
	87	377 - 380
	88	381 - 384
	89	385 - 389
	90	390 - 393
	91	394 - 397
	92	398 - 402
	93	403 - 406

DIRECTIONS for using the convenient tables for a quick determi upper critical point of steel from the chemical analysis: From T mine the basic temperature from the carbon content of the steel. II and Table III determine the number of degrees to be added to from the basic temperature for the phosphorus, silicon, vanadium and nickel contents of the steel, noting from the signs under whether the correction is added or subtracted. *From Table IV (steels containing nickel) make an additional increase in temperat sary.* To use Table IV observe the following procedure: Find nick steel in first column. If the corresponding figure in second colum than the carbon content of steel this correction is not used. If it is it from the carbon content of the steel and add double this amou temperature.

Example: Find the upper critical temperature (Ac_3) of a st following chemical analysis: C, 0.40; P, 0.017; S, 0.23; Mn, 0.74; 0.37; Si, 0.20. Sulphur and chrome have no effect and are ignor shows basic temperature of 40 carbon to be 819 deg. C. From Ta deg. for phosphorus, 6 deg. for silicon, and subtract 25 deg. for From Table III, an additional 70 deg. must be subtracted for the a net temperature of 737 deg. C. Since the steel contains nickel T also be used. From Table IV, carbon corresponding to 3.03 pe is 36. This is less than the 40 carbon of steel, therefore subtract and double the result which gives 8 deg. Add this to 737 deg., wh deg. C. as the final Ac_3 temperature.

TABLE III C. Deg. Correction	Nickel In 1/100 (Subtract)
94	407 - 410
95	411 - 415
96	416 - 419
97	420 - 423
98	424 - 428
99	429 - 432
100	433 - 436
101	437 - 441
102	442 - 445
103	446 - 449
104	450 - 454
105	455 - 458
106	459 - 463
107	464 - 467
108	468 - 471
109	472 - 476
110	477 - 480
111	481 - 484
112	485 - 489
113	490 - 493
114	494 - 497
115	498 - 502
116	503 - 506
117	507 - 510
118	511 - 515
119	516 - 519
120	520 - 523
121	524 - 528
122	529 - 532
123	533 - 536
124	537 - 541
125	542 - 545
126	546 - 549
127	550 - 554
128	555 - 558
129	559 - 563
130	564 - 567
131	568 - 571
132	572 - 576
133	577 - 580
134	581 - 584
135	585 - 589
136	590 - 593
137	594 - 597
138	598 - 600

TABLE IV (Special Nickel Correct For High Carbons)	
Nickel In 1/100	Carb
0 - 8	
9 - 25	
26 - 41	
42 - 58	
59 - 75	
76 - 91	
92 - 108	
109 - 125	
126 - 141	
142 - 158	
159 - 175	
176 - 191	
192 - 208	
209 - 225	
226 - 241	
242 - 258	
259 - 275	
276 - 291	
292 - 308	
309 - 325	
326 - 341	
342 - 358	
359 - 375	
376 - 391	
392 - 408	
409 - 425	
426 - 441	
442 - 458	
459 - 476	
477 - 491	
492 - 508	
509 - 525	
526 - 541	
542 - 558	
559 - 575	
576 - 591	
592 - 608	

quick determination of the
lysis: From Table I deter-
of the steel. From Table
be added to or subtracted
on, vanadium, manganese
signs under each column
Table IV (only used in
in temperature if neces-
e: Find nickel content of
second column is greater
sed. If it is less, subtract
le this amount to the Ac_3

Ac_3) of a steel with the
; Mn, 0.74; Ni, 3.03; Cr,
nd are ignored. Table I
C. From Table II, add 7
t 25 deg. for manganese.
cted for the nickel, giving
ains nickel Table IV must
g to 3.03 per cent nickel
efore subtract 36 from 40
737 deg., which gives 745

TABLE IV

l Nickel Correction
r High Carbons)

00	Carbon In 1/100
	54
	53
	52
	51
	50
	49
	48
	47
	46
	45
	44
	43
	42
	41
	40
	39
	38
	37
	36
	35
	34
	33
	32
	31
	30
	29
	28
	27
	26
	25
	24
	23
	22
	21
	20
	19
	18

tions were then repeated and the following represent final effects.

Ac_3 for pure iron is 908 deg. C. (first trace of carbon).

0.01 per cent carbon lowers Ac_3 by 2.237 C. deg.

0.001 per cent phosphorus raises Ac_3 by 0.4385 C. deg.

0.01 per cent silicon raises Ac_3 by 0.3049 C. deg.

0.01 per cent vanadium raises Ac_3 by 0.3792 C. deg.

0.01 per cent manganese lowers Ac_3 by 0.3443 C. deg.

0.01 per cent nickel lowers Ac_3 by 0.23 C. deg. (but increases it by 2 ($C - 54 + 0.06\ Ni$) provided the quantity in the bracket is positive).

All of the above can be expressed as a single equation as follows:

$$\text{Temperature of } Ac_3 = 908 - 2.237\ C + 0.4385\ P + 0.3049\ Si + 0.3792\ V - 0.3443\ Mn - 0.23\ Ni + 2(C - 54 + 0.06\ Ni)$$

where all the elements are expressed in hundredths of a per cent, except phosphorus which is in thousandths. If the quantity in the last bracket is negative it is omitted.

Example: What is the Ac_3 temperature for a steel with the analysis, *C*, 0.40 per cent; *P*, 0.017; *S*, 0.23; *Mn*, 0.74; *Ni*, 3.03; *Cr*, 0.37; *Si*, 0.20? The sulphur and chrome have no effect and are therefore neglected.

Ac_3 temperature $= 908 - 2.237 \times 40 + 0.4385 \times 17 + 0.3049 \times 20 - 0.3443 \times 74 - 0.23 \times 303 + 2(40 - 54 + 0.06 \times 303) = 745$ deg. C.

The actual Ac_3 temperature found by experiment on this steel was 748 deg. C. For heat treatment this steel should be quenched from slightly above 745 deg. C.

Additional example: Consider the heat treatment of steel such as S.A.E. 3135. This steel has a range of elements instead of a definite analysis, and to get the correct heat treatment, all of the equations must be applied in such a manner that there is found the lowest and highest Ac_3 which is possible to get if the elements occurred first so that everything tended to give a low Ac_3, and second if they tended to give a high Ac_3. If they are grouped according to lowest and highest effects, there is found: Basic temperature (908 and 908), carbon (−89.5 to −67); phosphorus (0 to 17.5); silicon (4.5 to 9.0); manganese (−27.5 to −17.0); nickel (−34.5 to −23). The Ac_3 temperature is, therefore, 761 deg. C. for a minimum, and 827.5 deg. C. for a maximum. Since it is extremely improbable that a steel would have a combination of elements to give either the high or low Ac_3, the quenching temperature could be taken as midway between the two extreme temperatures. It is often advisable to add about 15 C. deg. to the calculated quenching temperature in order to allow for inaccuracies in furnace pyrometers and metal analyses.

Performance of Cutting Fluids When Sawing Metals

CUTTING fluids appreciably affect the rate of dulling of tungsten-steel hacksaw blades. Consequently they affect the time necessary to cut a given cross-section when operating under a given feed pressure. A cutting fluid giving a short sawing time with a sharp blade does not necessarily give relatively short times after the blades become dull. Shorter sawing times and least wear on the saw blades were experienced when using sulphurized oils. The 1 to 50 emulsion was found to be better than a straight mineral or a mineral-lard oil.

The foregoing observations were made in progress report No. 5 of the subcommittee on cutting fluids of a special research committee on cutting metals of the American Society of Mechanical Engineers. The report, which was prepared by Prof. O. W. Boston and C. E. Kraus, College of Engineering, University of Michigan, Ann Arbor, Mich., was presented to the annual meeting of the society in New York, and was in part as follows:

Tests were conducted on a Peerless high-speed 9-in.-capacity power hacksaw at the University of Michigan. The time required to saw off a 1½-in. square section of Bessemer screw stock was recorded. The conclusions arrived at are based on fixed conditions; that is, a specific saw blade operating under a constant tension with the feed lever in the twelfth notch, giving a maximum feed pressure of 119 lb. and with a constant cutting speed of 120 strokes per minute for the 6-in. length of stroke.

S.A.E. 1112 steel, cold drawn to a 1½-in. square section, was used in the tests. An emulsion of 1 part soluble oil to 50 parts water was first used with a high-speed-steel hacksaw blade, 17 in. long, 1 in. wide, 0.065 in. thick. It had six teeth per inch, with a set of right, left, two straight, and cut a kerf of 0.082 in. The sawing time of this blade was found to increase uniformly from about 1.3 to 1.4 min. in the first 30 cuts (67½ sq. in. of metal), after which there was no appreciable change in cutting times. The test was stopped after the sixty-fifth cut, and the blade showed no visible indication of wear other than polished tooth points. Further tests were then run using tungsten-steel blades to reduce the time of the wear tests. These blades were 12 in. long, ¾ in. wide, 0.049-in. gage, having 14 teeth per inch set right, left, straight. The four cutting fluids used were the 1 to 50 emulsion, a light mineral oil, a mineral- (10 per cent) lard oil, a sulphurized mineral oil.

For the tungsten-steel blade with the 1 to 50 emulsion, a marked increase in sawing time was found up to the fifteenth cut and a more gradual and non-uniform increase to the sixty-fifth cut, after which the time increased rapidly for each successive cut. The teeth at the end of the test were worn down about one-fifth of their height so that very appreciable flats were visible. One tooth was broken out.

When the mineral oil was used the cutting time was increased more rapidly than with the emulsion. At the end of the test nearly one-third of the height of the teeth were worn off and three teeth were broken out. The greatest rate of dulling was found with the mineral-lard oil, which showed a low sawing time for the first cuts, but was more than doubled in the 65 cuts taken, increasing from 1.5 to 3.3 min. The blade showed somewhat more wear than with the mineral oil and had six teeth broken out. The sawing time when using the sulphurized mineral oil increased slowly up to the twentieth cut, after which it increased more rapidly. At the end of the test, however, very little wear was apparent on the teeth.

The time per cut for the first, fifth, twentieth and sixtieth cuts for the four cutting fluids is as follows: The emulsion, 1.7, 1.8, 1.9 and 2.2 min.; the mineral oil, 1.9, 2.1, 2.3 and 2.9 min; the mineral-lard oil, 1.5, 1.8, 2.2 and 3.2 min.; and the sulphurized mineral oil, 1.4, 1.5, 1.7 and 2.1 min.

Using a new high-speed-steel blade and a given cutting fluid, three series of cuts were taken on each of eight metals tested. The metals were a cast aluminum alloy, S.A.E. 33; a rolled leaded free-cutting brass; cast iron; malleable cast iron; and four S.A.E. steels, 3150, 1020, 1035 and 1112.

The 11 cutting fluids were dry cutting; 1½ per cent borax in water; 1 to 50 emulsion; 1 to 10 emulsion; No. 1 lard oil; light mineral oil; heavy mineral oil, mineral, (10 per cent) lard oil; a 5 per cent oleic acid-mineral oil; a sulphurized mineral oil; and a sulphurized-lard mineral oil.

The time for the first cut in each metal was low and varied most from the average of the three cuts. This was particularly true for the brass and free-cutting steel. Considerable differences in the time required to cut with the different cutting fluids were noticed, and their effectiveness varied with the metal sawed. The cutting fluids had least effect on the aluminum, malleable cast iron, cast iron and brass, and most effect on the steels. The two sulphurized oils consistently gave shortest cutting times.

Malleable Castings by the Du

By CLARENCE B. TEETER

THE malleable castings process with which the author is familiar uses the cupola and the electric furnace by which is regularly obtained castings having a minimum tensile strength of 70,000 lb. per sq. in. of cross section by maintaining an annealing cycle of approximately 24 hr. It would seem that a small plant desiring to produce, for instance, 35 tons of salable castings daily might entertain the installation of a small continuous melting cupola from which 60 per cent of the charge of the electric furnace might be provided. The introduction into the mixing ladle of a de-sulphurizing agent will eliminate the high sulphur content of the cupola metal, making it even possible to use gray iron machinery scrap and briquetted ferrosilicon in lieu of pig iron to be mixed with the returned sprues in the cupola.

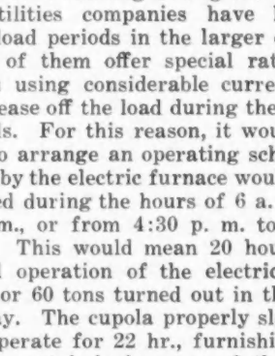
The cheapest steel scrap available is perhaps structural steel or boiler plate rivet hole punchings. Forty per cent of this steel or shearings duplexed with 60 per cent of molten cupola metal in an electric furnace should not consume over 250 kwhr. per ton poured into the molds. If the metal is all melted cold in the electric furnace, the product per day is limited to a smaller tonnage per hour and an electric current consumption of nearly 600 kwhr. per ton poured into molds is to be expected.

An appreciable amount of electric current is consumed in heating up an electric furnace. Utility companies selling current (to offset an unbalanced load through the 24 hr.) offer inducements to make it mutually desirable to operate electric furnaces through the night as well as during the day. This would require 24-hr. cupola service, and, if necessary, having the molds made during two or three molding shifts to take this intermittent product of the electric furnace.

The Case of a 60-Tons-a-Day Output

An ideal arrangement would be the casting of a certain tonnage daily of gray iron as an auxiliary product to the malleable iron to be produced. Thus in the event the electric furnace cannot take the accumulated continuous flow from the cupola, this excess would go into the gray iron castings. As this discussion deals entirely with the production of malleable castings, we shall assume that only a small amount of gray iron castings is desired. If a large amount is likely, a larger cupola diameter should of course be anticipated.

Assuming that we shall wish to pour 60 tons daily into malleable castings and 8 to 10 tons daily into gray iron castings, we would consider a cupola lined down to melt 2 tons an hour and capacity for a product from the electric furnace of 3 tons an hour. Two such cupolas would be required, one being cooled off and repaired while the other is running during the 24 hr. As utilities companies have heavy peak load periods in the larger cities, many of them offer special rates to plants using considerable current, if these ease off the load during the peak periods. For this reason, it would be well to arrange an operating schedule whereby the electric furnace would not be used during the hours of 6 a. m. to 8 a. m., or from 4:30 p. m. to 6:30 p. m. This would mean 20 hours of actual operation of the electric furnace, or 60 tons turned out in the 24-hr. day. The cupola properly slagged can operate for 22 hr., furnishing no cupola metal during one of the two electric furnace shutdown periods. The cupola melting from 6:30 p. m. until 4:30 p. m. the following day would hence turn out 44 tons of gray iron, 35 tons of which would go into the electric furnace to make the 60 tons for malleable iron molds.



The sprues (gates, risers and defective castings) from 60 tons of malleable iron molds would be approximately 25 tons daily and from the gray iron castings would come an additional remelt of about 3½ tons, both of which added to 15½ tons of pig iron or gray iron foreign scrap and ferrosilicon would produce the desired 44 ton daily product of the cupola. To 35 tons of this molten cupola metal would be added 25 tons of steel scrap to result in the 60 tons of molten product from the electric furnace in 24 hr. From the above practice we would then obtain about 35 tons of salable malleable castings and about 5½ tons of salable gray iron castings in a period of 24 hr., by using 15½ tons of gray iron machinery scrap with a little ferrosilicon and 25 tons of the cheapest steel scrap. Certainly that should result in a very low cost per ton for raw materials and melting fuel.

The Labor Personnel Required

Now let us consider the labor personnel: A cupola tender at the spout, an electric furnace attendant, two cupola and electric furnace chargers, a man to distribute molten metal by trolley ladle to the molding floor, and a straw boss over this gang, who would also pour a few gray iron molds intermittently as required. These six positions throughout 24 hr. would call for a total of 24 men, each working 6-hr. shifts. Add to these one 6-hr. shift of two men employed for cupola and ladle repairs and we find that 26 men or 156 man-hours will supply the 40½ tons of salable castings each 24 hr.

It will readily be seen that with this continuous melting operation requiring perhaps two or three molding shifts during the 24 hr. day, an inexpensive installation of mechanical equipment for continuous molding, pouring and sand conditioning might later be entertained. The author knowingly risks the disapproval of many readers in this premise, for such a layout of mechanical equipment is

he Duplex Method ▲ ▲ ▲

BY operating a small electric furnace in connection with a small cupola, the author suggests how low-cost malleable castings can be made. Notable in the equipment he proposes is a continuous annealing furnace providing for a 24-hr. annealing cycle. The items of labor and material are calculated in some detail. Mr. Teeter is a resident of Chicago, not now connected with the malleable iron industry nor interested in the sale of foundry equipment or supplies. His authority for writing on the subject appears to be based on an experience as an operating executive in a malleable iron foundry.

as unorthodox to the average malleable foundryman as would be a proposal at this time to the more progressive minded that we perhaps install a set of photoelectric cells and arrest some of the energy of the cosmic ray and abounding planes to run our foundry machinery and furnaces in the future.

We will accordingly put discussion of this possibility aside for the next few years, but the matter should not be disposed of without stating that we surely have plenty of good engineers who should have the ability to devise a very simple, practical and inexpensive mechanical layout that would be adaptable to the changing nature of the trade catered to, and even to short order jobbing work, as well as to a strictly specialty shop. A specialty shop layout should and could be avoided as well as a too elaborate investment which would not function with good results in, God forbid, future periods of depression with the plant more or less idle. Such a revolutionary equipment installation should make possible a foundry operation whereby 35 tons of salable castings daily would be produced with less than 2 man-hours per ton to cover all molding, pouring and the incidental foundry labor required.

An Annealing Cycle of 24 Hr.

Castings from this electric furnace process may be annealed in a complete cycle of 24 hr., leaving the annealing oven at a temperature of about 1100 deg. The tensile strength of these castings should be a minimum of 70,000 lb. per sq. in. of cross section and, with an added treatment after leaving the annealing oven, it is possible to increase the tensile strength in excess of 90,000 lb. with no great amount of added time interval, labor or other expense. To accomplish this daily anneal on a relatively high or normal production per day, a specially designed continuous oven should be contemplated. It has been found that castings from this metal were thoroughly annealed by following a regular routine of holding them at annealing temperature for a period of only 4½ hr. and cooling as rapidly as 40 deg. per hr.

It is therefore safe practice to divide the 24 hr. of the cycle into five parts of 4¾ hr. each. The first period of 4¾ hr. would be consumed in raising the castings to annealing temperature, the second 4¾ hr. would be devoted to soaking the castings at annealing temperature, the third and fourth periods of a total of 9½ hr. would be consumed in cooling the castings from annealing temperature to a temperature approximately 300 deg. lower, and the final 4¾ hr. period would be consumed in continuing the cooling to approximately 1100 deg., when they may be removed from the oven to cool as rapidly as possible in the building or out of doors.

The 24-hr. cycle being divided into five parts, it follows that the oven should be divided into five units or chambers (four chambers, as the first cooling chamber would be of double the length of the others). To determine the length of these chambers it must first require that the daily tonnage be considered. Assuming an average daily annealing requirement of 25 tons and considering a twin oven or two parallel integral tunnels served by a common flue between them, this would mean that each of the twin compartments would be required to handle 12½ tons.

Size and Design of Annealing Oven

These 12½ tons split into five parts would mean 2½ tons for each unit of length of the oven, so that a length of 12 ft. and a width of 5 ft. would be required to anneal a layer of castings averaging 83 lb. per sq. ft. of surface. This would be a fairly shallow layer of castings, which might with safety be slightly increased if needed. A 25-ton daily anneal, 7 days a week, would take care of the 35-ton daily production of castings from the foundry operating five days per week.

This twin oven consisting of two compartments, each representing five 12 ft. lengths, would then have each compartment length loaded and unloaded every 4¾ hr. of the 24-hr. day. An oven of a trifle over 60 ft. in length would then be the requirement. As different degrees of temperature are to be imparted to the castings traveling at those intervals through the oven, it becomes necessary that each unit of the compartments be divided by counter balanced sliding doors into chambers.

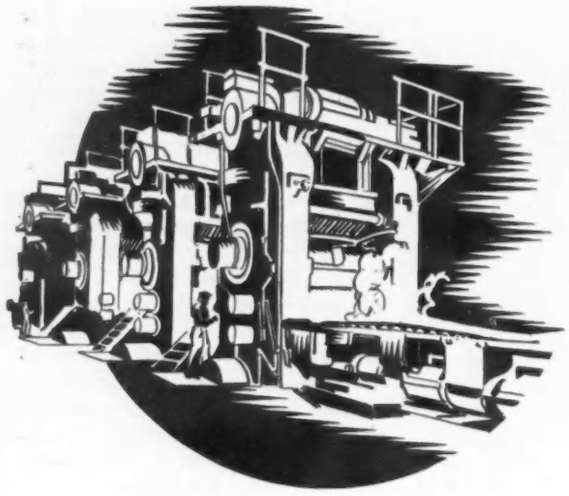
After a unit to be annealed is properly loaded with castings, the several doors of the compartment would simultaneously be raised. The automatic clutch to the drive from a common motor for these twin compartments would move the several units of castings through the entire length of the compartment. This would carry the castings just loaded into the first chamber to be heated to annealing temperature, and so on through the several stages for each unit of the load; the lot cooled to about 1100 deg. in chamber No. 4 would move entirely out of that compartment, and the unloading would be started, with the hot castings remaining under a hood to arrest the rising heat while being unloaded. All doors simultaneously would then be closed and another period of the annealing cycle again repeated.

With thermocouples permanently inserted in these various chambers and leading to a recording pyrometer, the process of annealing through the manipulation of burners and cooling doors could be made a routine of exact performance. If fuel be used for heating, a muffled chamber would not be required to prevent oxidization of the castings as the contact with hot gases and excess air would be a short interval of time, but a combustion chamber with ports to distribute the heat evenly to the castings would be desirable.

Economics of Continuous Annealing Oven

An estimate of the cost of constructing such an oven and its me-

(*Concluded on Page* 64)



Methods of Rolling Sheets

By FRANK L. ESTEP
Vice-President, Perin Engineering Co.
New York

IN the office of a consulting engineer an inquiry regarding the manufacture of sheets may come from any point in the world. It may come from countries where sheets have been made for years; it may emanate from countries where steel plants now exist and the question has been brought up regarding the possible profits to be derived from sheets; or it may originate from some country where there is no existing steel plant but where it is thought that a steel industry could be established and include in it the manufacture of sheets; it might even have been thought possible to buy sheet bars from other countries and through governmental protection, be able to build up a local and profitable industry.

In connection with the problem of manufacturing sheets many factors including the following must be considered:

1—Tonnage.
2—Size, gage, and quality.
3—Markets available within competitive distances.
4—Source of raw materials from which to make sheets.
5—Whether there already exists a going steel plant.
6—Whether there is an existing sheet mill, and if so, of what type, capacity and physical condition, and what is the investment in the same.
7—Does any skilled labor exist locally; and what are the rates of wages for labor of all kinds; what is the quality, physically and intellectually, of local labor; and can it readily be trained into the various degrees of skill necessary for successful and economical management and operation of the plant.
8—How much foreign supervisory and operating force must be imported at a high wage premium, for what positions, and how soon can it be dispensed with.
9—Cost of power.
10—Cost of fuel.
11—Can governmental protection be secured; if so, for what amount and for how many years.
12—If it is a Government project, do they wish to be entirely independent of other nations.
13—What facilities exist for properly housing the employees.
14—How much total money must be made available to cover:
(a) Plant cost.
(b) Interest during construction.
(c) Losses during initial operation.
(d) Working capital.
15—Will the proposition pay, making proper allowance for interest and depreciation and in how many years can the initial plant cost be amortized.

All of the above factors are important and have quite a bearing upon the type of plant and equipment which should be proposed for the tonnage and quality of sheets under consideration.

Plant Size to Insure Profit

It is very difficult and usually impossible to show a profit on production as small as 15,000 to 20,000 tons per annum. If the tonnage should range from 40,000 to 60,000 tons, the problem is at once simplified, as the cost of plant per ton of production would be less and the overhead and fixed charges lower; if the capacity be up to 100,000 tons, the prospects of profit are still more favorable, as the plant overhead could just as readily be spread over 100,000 tons as over 40,000 tons.

If the tonnage involved should be above 100,000 tons per annum up to say 200,000 tons, the consideration of the type of equipment necessary would be much along the same lines as for 50,000 to 100,000 tons. On the other hand, however, if it can be definitely and conservatively determined and agreed upon that, in the comparatively near future after the initial operations, the market would absorb an increase to 300,000 tons or more per annum, then the problem immediately takes on a different outlook and must be considered accordingly.

The question of gages, the percentage of ordinary grades for galvanizing purposes, and particularly the tonnage required for deep stamping purposes also have a very material bearing on the whole proposition. In certain cases it may be found that the percentage of ordinary black sheets from No. 12 to No. 16 gage is a considerable amount of the total tonnage; in many cases it will be found that the primary question to be considered is the manufacture of galvanized sheets of ordinary grades. The type of equipment for these two classes falls within the same range of mills and accessory apparatus.

The Cases of Special Quality

When you come to the question of deep stamping sheets and particularly to the question of the very highest grades, such as are necessary for auto bodies, then the equipment must be more carefully and differently considered than for the case of ordinary black and galvanized sheets.

In the manufacture of many grades of deep stamping sheets and the manufacture of practically all auto body sheets, the question of surface becomes of paramount importance along with the deep stamping qualifications; hence the layout should embody every known facility that will reduce handling to the absolute minimum and the equipment provided be such as will prevent to the greatest degree the possibility of marring or scratching, or otherwise impairing the surface of the sheets.

We would like to say that even with the best sheet mill plant that man and money could build, you would not be able to make the latter mentioned deep stamping quality of auto body sheets without being able to either make or buy the proper steel necessary for the purposes intended. Great attention has been paid during the past 10 to 20 years to the making of high-quality steel for such purposes

and marked improvements have been made.

What we are trying to point out is the fact that what might be the proper plant and process to propose for one company or country might not be the proper one at all for some other company or some other country; each is a specific individual problem and must be treated accordingly.

Quality and Quantity Demands of the Automobile

Until comparatively recently in this country the old type of hand mills were in existence and in full operation when the demand for sheets warranted their running at capacity. They employed a large number of men who received very high wages, particularly the roller, heater and doubler. In practically all such mills there was an extremely large amount of manhandling of materials throughout.

When the automobile manufacturers began to demand sheets to increasingly severe specifications regarding deep-stamping qualities and surface, certain of the old-type mills were modified in order to produce sheets of a quality and finish suitable for the automobile trade. The increase in the automotive industry called for a further increase in tonnage of sheets to even more severe specifications. This required additional expenditures in the plants for various equipment which previously had not been needed for ordinary grade sheets. These included normalizing furnaces; better and cleaner methods of pickling; scrubbing and drying machines; roller levelers, hydraulic stretchers, and all manner of apparatus. In addition to the expenditure involved, there was also a very marked increase in labor per ton due to the increase in the number of operations required from bars to finished sheets and the necessary number of men required for the additional handling.

Former First Costs

Up to 15 years or so ago a new sheet mill, complete, to produce black and galvanized sheets of ordinary qualities cost approximately $1,500,000 for 50,000 to 60,000 tons of sheets per annum. To produce the same tonnage of high-grade sheets there would be an increase in plant cost of 25 to 35 per cent.

About eight years ago, when the automotive sheet business had reached considerable proportions and had the earmarks of further rapid increase, great impetus was given to the manufacture of sheets by the first installation of four high continuous hot mills to convert a slab approximately 3 in. thick into a strip from 1/16 in. minimum thickness and 30 in. wide to ⅛ in. thick and 48 in. wide. One installation led to others until today there are several such mills, in some of which it is possible to roll perhaps 60 in. wide to as thin as 1/16 in. from 2½ or 3-in. slabs.

There were many difficulties to be overcome in the original installations of this type of mill, among which were those of rolls and roller bearings to withstand the punishment of heavy reductions on wide metal at high speeds. These troubles were gradually overcome and today the roll cost per ton and the maintenance charges are comparatively low.

The striking feature in connection with the conversion of a slab into hot-rolled strip on this particular type of mill was the extremely low labor cost per ton. In other words, the operation was done with practically no labor. The cost of such plants is very high and if an average were taken of the plants now in existence in the United States, it would probably be found that none cost less than $6,000,000 and some have cost between $8,000,000 and $10,000,000.

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THE fast-moving and marked changes of recent years in the processes for rolling sheets rightly call for a writing down of what has occurred, and in the accompanying article Mr. Estep has supplied the need. It is a reprinting in large part of a paper presented Dec. 7 in New York before the American Society of Mechanical Engineers.

From the vantage point of the consulting engineer, Mr. Estep not only epitomizes current procedure but takes a look into the future. His analysis of methods goes into the economics of sheet rolling as well as the character of the equipment. Features of his discussion include a classifying of present practices into four groups; also a listing of numerous factors which must be considered in a sheet mill undertaking. About the only omission from the original paper is a description of what may be termed the conventional method of sheet rolling that has persisted through the years until the present era.

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Fixed Charges per Ton in Continuous Mills

IF these various four-high continuous hot strip mills were equipped with the necessary capacity of furnaces for reheating slabs before rolling and be given the necessary equipment to take away the material at the maximum rate of rolling, any and all of them could be pushed to a production of 500,000 to 750,000 tons of strip per annum.

Allowing 15 per cent interest and depreciation on a plant costing $8,000,000, with 600,000 tons production per annum the fixed charges per ton would be $2; with 400,000 tons, the charges become $3; but if the tonnage dwindled to 200,000, the amount would become $6 a ton.

This question of fixed charges per ton of production has been a great hardship during the past and present depression in connection with all four-high mill installations, as many of them were installed toward the decline of the previous high production period and there had been no time to write off the investment to any extent.

The introduction of the four-high mills into the manufacture of hot-rolled strip brought about other features connected with the further conversion of this hot-rolled strip into sheets. This operation has been done by different methods.

Advent of Continuous Cold Rolling

Originally the idea was to take hot-rolled strip of the width required for the final sheet plus side scrap, cut the strip into breakdowns, and then hot-roll these down to the final gages in the same manner as would have been done had the rolling started with bars. During the time the four-high mill was being perfected as a hot rolling unit, consideration was being given to its use as a cold rolling unit.

It was first thought by many that it would be impossible to punish hot-rolled strip by cold rolling to any great extent without annealing to soften it for further cold rolling. However, by increasing the size and strength of the mills to withstand the necessary working pressures and providing sufficient power, it has been proved conclusively that a properly designed four-high cold mill can cold-roll the hot-rolled coils from 0.109 in. thick or thicker to 0.030 in. and thinner without annealing and give the metal reductions of 30 to 50 per cent per pass. Coils have been cold rolled from 0.250 to 0.010 in. without annealing.

These cold mills require a tremendous amount of power and are very expensive but further experience with their use in cold-rolling strip to sheet gages and to the thinner gages of tin plate (0.012 to 0.0105 in.) will eventually prove them to be feasible and exceptionally low conversion cost units, provided, of course, that one has tonnage sufficient to justify the expenditure for hot strip and cold strip mills, or can buy hot-rolled strip at a reasonable price to roll on the cold mills.

Improvements to Old Type Mills

WHILE the above-mentioned development of the four-high mill as hot and cold-rolling units was taking place, the very large number of companies manufacturing sheets by the old-type methods, i.e., hot rolling

in packs, found themselves being left in the lurch on costs, particularly when the demand for sheets was at the peak. They had certain investments in their existing plants and began to cast about for ways and means of increasing their production per unit of equipment and per man, and thereby be able to reduce their costs to a point which would permit their product to become competitive with sheets produced by hot strip mill rolling and the finishing methods then practiced.

This led to the development and use of several kinds of equipment applicable to existing sheet mills, included among which are:

1—Continuous pair and continuous pack furnaces for heating bars for roughing and heating breakdowns and packs for finishing.
2—Equipping the ordinary two-high hot mill with automatic front and back tables.
3—Improvement in mechanical doublers.
4—Installation of conveyors and various mechanical means of handling material between the different points of operation.

In the present type of continuous pair furnaces the bars are charged either singly or two high, in one row or in two rows, and delivered automatically to the roughing mill by pushing a button on the roll housing. The temperature is controlled to the degree required for proper heating. High-grade bars are heated to a lower and more uniform temperature than bars for ordinary sheets. In the pair furnace the same process applies, viz., packs charged into the rear of the furnace and properly spaced by hand are delivered to the mill by pushing a button.

Automatic tables, front and back of the finishing rolls, have done many things to decrease costs and increase production. On packs the return is faster than can ordinarily be attained by hand, and the entry of the pack into the mill from the front table can be made quickly and exactly central. With pack furnaces of sufficient heating capacity as have now been designed and perfected, and with the control for furnace discharge and delivery of packs to the mill as has also been made successful, it is possible to operate a two-high finishing mill equipped with these automatic tables with two men on the front side (one as a spare) and no one on the catcher's side.

High Performance in India

Skill and speed with this equipment have been attained to such a degree that on one mill in India, finishing packs to sheer 96 in. long, giving them one pass "run over" and after reheating three passes "finish," four passes total, an average time of 28.173 sec. finished pack to finished pack on to the cooling conveyor has been maintained for over six hours. This rate of operation shows that 26.6 per cent of the roll surface was actually in contact with metal during the entire 6-hr. period.

An extremely high rate of rolling, such as the above, will raise the temperature of the rolls to a dangerous degree unless the closest attention be paid to this feature. Since the finishing rolls are chilled iron, there is a limit to the temperature at which they will successfully operate and the heat which is poured into them from contact with the hot packs on the various passes must be dissipated at a rate sufficient to keep the surface temperature to about 700 deg. F. maximum. Beyond this the rolls are liable to breakage, or low life due to overheating.

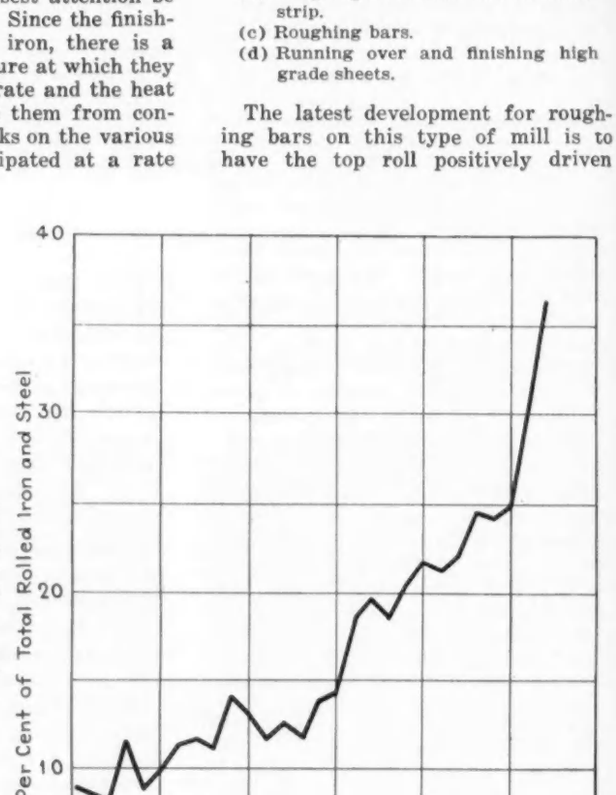
The maximum output per 8-hr. shift known to the writer as having been rolled on one two-high mechanically equipped finishing mill is 60 gross tons sheared opened and weighed material 0.0225 in. thick. This was a recent performance cabled from India and detailed information including the exact number of packs rolled has not been received as yet.

The Three-High Single Stand Mill

Another item of equipment connected with rolling sheets has again come to the front. We refer to the three-high mill, which is an old and well known type of mill used for many years as the finishing stand of a jobbing mill, and for that purpose had large diameter top and bottom rolls and a smaller middle roll. The bottom roll only was driven, the mill therefore operating as a "jump" mill. This type of mill is now being used for different operations in the manufacture of sheets such as:

(a) Roughing universal mill hot rolled strip.
(b) Roughing continuous mill hot rolled strip.
(c) Roughing bars.
(d) Running over and finishing high grade sheets.

The latest development for roughing bars on this type of mill is to have the top roll positively driven through pinions, the top and middle rolls counterbalanced, and the middle roll actuated by the tilting of the back table. It is customary practice when roughing a pair of sheet bars to give them each one pass through the bottom and after returning through the top on pass No. 2, match them automatically and then give them three additional passes, five total. It is claimed that bars to shear approximately 60 net tons of sheets can be roughed in 8 hr. It is our belief that this may be increased by a close study of table and mill operations and slight changes in the tables and controls to save every fraction of a second possible on the operating cycle. A time, pair to pair, of 20 sec. has been reached over short periods, but it is possible to cut this to an average of probably 16 sec. over an 8-hr. shift.



The percentage of the total United States production of rolled iron and steel that is represented by black sheets and black plates for tinning (with strips included since 1920) shows a particularly rapid rate of increase in late years.

Cooling and Polishing Rolls

The three-high mill needs a crew of only a few men. As usually operated, it is run as a "wet mill," mean-

ing that the mill is kept cold with water on the top and bottom rolls, the water being wiped off after it has come in contact with the rolls so that it cannot get on the sheets. The rolls must be ground differently from hot mill rolls.

This type of mill presents another advantage in that packs of two's roughed from pairs can be kept continually to practically the same length and thickness in a definite number of passes throughout the different shifts, and at the same time keep all packs to practically the same shape on their tail ends. This is an indication of the shape or contour of the roughing mill which must be definitely related to the shape or contour of the hot mill on which the packs are to be finished.

The question of automatic polishing of top and bottom rolls on a two-high hot mill has been solved to such an extent that the lost time previously necessary for hand polishing has been eliminated to a very great extent. Also, by proper control of the rate of travel of the polishing blocks across the face of the roll, it is possible not only to keep the surface in fair shape and free from specks of scale, but also keep down the "bearings" of the rolls, i.e., the points near the ends of the rolls just outside of the line of contact with the edges of the packs.

The use of automatic polishers on the top and bottom rolls of a three-high mill has not yet been tried, so far as we know, but will undoubtedly be attempted in the very near future. The probability is that when a three-high roughing mill is so equipped, the steel rolls can be kept in a sufficiently good condition to eliminate much of the changing of top and bottom rolls which is necessary today, particularly when roughing auto body sheet bars. The middle roll must be changed quite frequently, these changes being necessary every 6 to 8 hr. minimum to possibly 32 to 48 hr. maximum, dependent upon the grade of bars being roughed. Steps are being taken in design of the three-high mills to permit changing the middle rolls with the mill running and thus avoid the shutdown otherwise necessary for this operation.

Four Sheet Rolling Methods

GENERALLY speaking, the present practice of rolling sheets in the United States may be divided into four different methods:

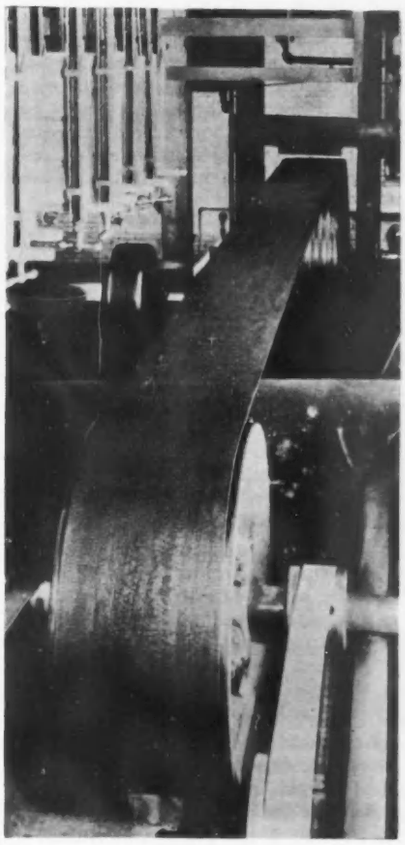
1—The roughing of 8 to 14-in. bars by hand, and after reheating, the finishing of these bars in packs to final gage and length by hand, all rolling being done on two-high mills. In some cases the mills are equipped with modern furnaces.

2—The roughing by hand of bars heated in continuous furnaces and the finishing of the packs on any one of a number of finishing mills, each fed by a continuous pack furnace and equipped with automatic mechanical tables. All rolls are two-high.

As has been pointed out, a modification of this is taking place because of the introduction of the three-high roughing mill to eliminate hand roughing.

3—The hot rolling to finish gage in packs, on two-high or three-high finishing mills equipped with automatic tables, of "break-downs" from a four-high continuous hot strip mill, after heating in continuous pack furnaces.

4—The cold rolling of hot rolled strip in long coils (weight ranging from probably 2000 lb. minimum to 6000 lb. maximum), from hot rolled thickness to final gage without annealing, either in single stands of four-high cold mills, or in stands of four-high mills placed in tandem.



THIS belt has run for 52 years and is still in service, according to the American Leather Belting Association. It is an 18 in. double leather belt running from a 72 in. pulley on a lineshaft to a 48 in. pulley on a countershaft in the plant of the W. A. Berkey Furniture Co. of Grand Rapids, Mich. It was installed in 1881. It was taken from the pulleys this year to dress and repair after 52 years of continuous service. The belt maker that dressed the belt said it looked as if it had never been repaired before. The superintendent also said he could not remember the belt being taken from the pulleys before.

The belt was pegged with 6 rows of wooden pegs its entire length. That was evidently supposed to make it better in The Gay Nineties.

As has been mentioned, the labor cost per ton of finished product is undoubtedly the lowest by the last named process. It has also been indicated that the cost of this type of plant is very high, and unless enough tonnage is available as a divisor, the fixed charges per ton of product may be high and prohibitive.

Likely Early Future Development

LOOKING forward to the future development in the next few years, assuming, of course, that the steel industry comes back into its own and that there is again sheet tonnage enough to justify the necessary expenditure, it is entirely within the realm of reason, based upon past performances, to look forward to something like the following:

1—The hot rolling of heavy slabs into coils, to widths slightly over that required for the final sheet, and to a thinness that will be most economical for the combination conversion from slab to final sheet gage by hot and cold strip rolling. Due consideration must be given to the evenness of gage from one end of the hot rolled strip to the other.

2—The spot welding of these coils one to the other; passing them through a continuous pickling, scrubbing and drying machine; and the cutting out of these welds and recoiling into coils after pickling.

It may be possible further to perfect the process of end-butt welding to such an extent that cutting out the welds will not be necessary. In other words, perhaps the welds can be made strong enough to stand the punishment of cold rolling.

3—The cold rolling of these coils in four-high tandem mills with sufficient stands to reduce the metal to the final gage, and coil it after the last pass.

Again, as mentioned under 2, if end-butt welding can be perfected it may be possible to roll welded coils of exceedingly long lengths to final gage. This would eliminate to the greatest possible extent the time which is necessarily lost when removing a finished coil and starting a new one.

4—The annealing or normalizing of these very long finished coils in a continuous type of furnace which will be combined with a continuous pickling, scrubbing and drying machine and followed by a tandem stand of flattening cold rolls. It may also be possible to cut the metal coming out of the flattening cold rolls to the exact final or near final length on a flying shear. The sheets will then be ready for inspection, resquaring, roller or stretcher leveling, oiling and shipping.

If and when this be an actuality, then so far as labor is concerned, it would seem that the cost of conversion from an ingot to a final sheet will have reached the absolute minimum. The fixed charges will vary with the tonnage. In face of the present existing conditions in the steel and sheet industry in this country, it will probably be some years before the above complete set-up will be justified.

Collective Bargaining or

By M. C. RORTY

Past President, American Statistical Association, and Former Vice-President, International Telephone & Telegraph Co.

ANYONE who attempts to paint a true and unbiased picture of that confused tangle of fact and error which centers around the general idea of collective bargaining may well find need for more than the wisdom of Solomon and a greater patience than that of Job. From an economic standpoint the facts are rather simple and the conclusions rather obvious—but a determination of the economic facts and the necessary economic conclusions serves only to make it clear that the problem is less one of tangible and measurable elements than it is of human psychology. It appears, in fact, to be less important to secure an exact economic justice than, perhaps, with a lesser degree of real justice, to establish the belief that justice is maintained.

But even this is not enough. Very few of us, if we should confess the truth, really desire an absolute and exact justice. What we hope to obtain is *justice plus*—plus the opportunity to use our wits and our powers to secure at least some slight measure of advantage over our fellows. And even the most meticulous of moralists may feel justified, from time to time, in offsetting the minor but persistent injustices from which he cannot fail to suffer, even under the best of laws and law enforcement, by securing his share of *justice plus*—provided he may secure such advantage without too obvious injury to any one individual.

So, regardless of public protestations that economic justice is the goal, one very real motive in the demand for collective bargaining appears to be the conscious or subconscious feeling that, in a world where many individuals and closely or loosely organized groups are seeking special advantages, wage earners should not be denied their similar opportunities for special profit. Nor can such feeling be suppressed by any proof that the advantages which particular groups of workers may gain through collective bargaining will very certainly be at the expense of consumers as a whole, rather than of "capital," for this same fact is substantially true of all special economic advantages—in the end, the consumer pays.

Finally, also, the demand for collective bargaining is but one special manifestation of the fluctuating balance, in the economic field as elsewhere, between the social need for discipline and authority, and the equal social need for those checks and balances which shall prevent the abuses of power.

A Problem in Compromises

Here, then, are the major elements of the problem. The solution can never be fixed or absolute, but must represent one of those many eternally shifting compromises on which our social structure is, and must continue to be, founded.

If the writer were (as he has been) a subordinate manual worker, he might insist on his opportunity to organize and bargain collectively.

If he were an executive and employer (as he also has been) he would seek by all means in his power not only to satisfy and gain the confidence of his subordinate workers, but also to prevent their becoming entangled in the politics and strife of outside labor organizations.

And, finally, if he were primarily a consumer (as he now is) he would seek to hold the balance even—to see that collective bargains were not made on a basis to bring about improper price increases, that employers were duly stimulated to a considerate treatment of employees by fear of labor union activities, and that labor unions, on the other hand, did not gain such excessive power as to cripple or destroy necessary administrative authority, to stifle enterprise, or to bring about serious losses in productive efficiency.

Furthermore, just so rapidly as experience might establish a consensus of opinion as to any thoroughly sound and tested practices in employer-employee relations, he would establish such practices on a permanent basis by legal enactment, thus limiting future controversies.

No one, of course, will agree wholly with such compromise position, since a true compromise is of necessity the infinitesimal point of balance between infinite degrees and ranges of the uncompromising. Nevertheless, it may be of interest to consider the basic facts upon which such compromise, or a very similar one, should be based.

Economic Limitations

From the economic side, it is not difficult to prove that the margins of industrial and commercial profits which exist offer little or no opportunity for increases in wage rates at the expense of capital. If we exclude intercorporate duplications, the total of corporation dividends averages, year in and year out, less than 6 per cent of the national income. The majority of students of the problem believe that, after allowance for all losses in corporation operations, this 6 per cent represents no excess, but rather a deficit, as compared with a normal interest rate on the money actually invested in corporation equities. And even the most extreme estimate will not indicate that corporation profits, above a normal interest rate (say 5 or 6 per cent), exceed 3 per cent of the national income, or, perhaps, 4 per cent of the total of salary and wage payments and other direct or indirect returns for personal service. Such excess, at the most, represents hardly more than three years' normal gain in real wage rates during periods when our present economy is undisturbed by such conflicts as are certain to result from attempts at forcible reductions in profit margins.

Similarly, in spite of a few cases of excessive salaries and bonuses, there is little that might be gained from reductions in the larger salaries. Salaries in the $10,000 range and below represent, in most cases, an actual and very real competition in the market for the services of skilled executives and technicians. Above this figure individual salaries may appear large, but the competiton for skilled executives is still real, and the excess over the $10,000 figure in large organizations is rarely more than 1 or 2 per cent of total payrolls. As with the salary factor, so with the greater element of economic wastes, which take place more largely in the processes of merchandising and distribution than in those of primary production, the controlling consideration, from the standpoint of collective bargaining, is that any gains which may

Governmental Wage Fixing?

COLONEL RORTY believes that there is a general misconception of the significance of collective bargaining under the "New Deal." In the first place, the average margin of profit in industry is too small to permit material increases in wage rates. In the second place, the avowed purpose of the Administration to maintain balanced economic relationships will force public intervention in labor disputes when the interests of consumers or other trades or businesses are involved. The Government, in his opinion, will not allow business to be loaded with burdens that will impede recovery, and will of necessity subordinate collective bargaining to semi-judicial procedure under public control.

come through waste elimination or salary reductions should properly accrue, through lower prices, to consumers as a whole, rather than to the workers in the occupations immediately affected.

Mechanization Not the Answer

A very similar consideration applies to suggestions that revolutionary gains may be made through mechanization and improved technique. Here, again, any gains should accrue primarily to consumers as a whole—but the controlling factor in this instance is the limited field within which mechanization *is* possible *at any given time*. The processes of mechanization are continuous, with the result of steadily shifting to non-repetitive operations those workers who have previously been engaged on processes subjected to mechanization. As the result of this steady transfer of workers, the number of those engaged at any given period on purely repetitive and mechanizable processes rarely, if ever, exceeds 10 per cent of the population gainfully employed.

This sets a definite limit to sudden progress through technical advances, and is an explanation of the tendency for gains in productive efficiency to be substantially continuous at the rate of from 1 to 2 per cent per annum, varied only by occasional spurts of about 5 per cent, due to the taking up of accumulated slack under pressure of depression necessities.

All the preceding considerations lead to the conclusion that, from a strictly economic standpoint, there is little general justification for collective bargaining. Such bargaining, as a matter of plain arithmetic, can operate in the long run only to secure advantages for special groups of workers at the expense of other workers and of consumers as a whole.

If further evidence on this point were needed, it lies in the failure of organized labor to establish on a large scale its own industries and to take direct advantage for its own members of those possibilities for profit and for increased efficiency which are claimed to exist. Many labor unions have, or until recently have had, the financial ability to establish even major industrial enterprises. They are, politically, in position to claim and secure at least equality of treatment by public authorities as compared with private competitors—and popular sympathies, plus the support of their own membership, should give them a preferential position in many markets.

Their neglect or unwillingness to work out their own salvation on a large scale through cooperative industrial and commercial operations tends, therefore, to confirm other more direct evidence as to the absence of any general or substantial excess of profit margins which might be diverted into increased wage payments.

Psychological Considerations

Turning now from purely economic considerations to those in which the psychological element predominates, the first field for examination may properly be that of the circumstances which are under the control of the employer. As to these, no single statement will suffice. The writer, in 40 years of active experience as subordinate worker and executive, has had direct and indirect acquaintance with a range of working conditions varying from the absolutely intolerable to those that seemed to approach as closely to perfection as is possible in an imperfect world. To generalize within this range is impracticable. On the one hand is the employer (usually an individual) who rivals the worst qualities of Simon Legree. On the other are the many employers who, in the present emergency, have risked a close approach to bankruptcy for themselves or their companies in the effort to maintain employment for their working forces.

Probably the most important distinction from the standpoint of employment conditions is that between small and large-scale enterprises.

Conditions in small enterprises are determined very largely by the characteristics of particular (usually individual) employers. Industries, which from their nature lend themselves, as a whole, to operation in small units, but in large cities and by masses of relatively unskilled labor, tend, perhaps, to develop the lowest standards of working conditions, even though individual establishments may constitute exceptions to the rule. It is in such industries that the demand for labor organizations and collective bargaining appears to be most insistent and to have its fullest justification. On the other hand, in a great variety of small-scale commercial, mercantile and neighborhood industrial operations, employing a mixture of skilled and unskilled workers, personal relations between employers and employees, even if not devoid of occasional friction, appear to be close enough, in the majority of cases, to minimize the demand for unionization. This is particularly true in the smaller communities, where the pressure of public opinion is most effective in preventing the abuses which might otherwise develop—although in the larger centers the greater number of such miscellaneous employers affords an opportunity for mobility of the particular classes of labor involved which operates to a somewhat similar effect.

Enlightened Self-Interest as a Factor

It is, however, when we turn from small-scale to large-scale employment that the most significant conditions and trends are found—and it is here that the contradictions in the whole problem are, perhaps, most clearly in evidence. It is quite possible, if not indeed probable, that large-scale industry would, in due course, have de-

veloped its existing special science of personnel management without pressure from the labor unions—but it is very certain that such development has been greatly expedited by fear of labor union control. Certain excesses of labor union demands have, in fact, contributed to a very general improvement in working conditions, while at the same time tending to prevent the *unions themselves from realizing their objective of the closed shop in all major industries.*

Regardless, however, of the reasons for their development, the skilled executives and their personnel managers in the majority of American large-scale industries have arrived at certain definite and carefully worked-out labor policies. These contain both positive and negative elements. The positive elements spring from an enlightened self-interest which, in general, aims to pay somewhat more, rather than less, than market wages, and to secure low costs of production from skilled management and the good will of selected working forces, rather than through low-wage rates. To this same end, the training of foremen in the skilled and tactful handling of their subordinates has become a matter of special attention, pensions and sick benefits have been widely established, and provisions for safety, comfort and sanitation are very generally in advance of legal requirements.

The principal negative feature of these policies is that of opposition to control by outside unions and of insistence on dealing primarily with their own employees on matters of wages and working conditions. The prevalent open-shop policy is, of course, determined, in the main, by this desire to avoid labor union domination, although to some extent jurisdictional and other disputes and struggles within and among the national labor unions have contributed to its adoption.

The Function of the "Company Union"

The much-discussed "company union," in its various forms and modifications, serves both a positive and a negative function. The skilled executive quite frankly seeks to maintain such close contacts with his working forces as to recognize and rectify any legitimate grievances long before the company union can find reason to function. Under these circumstances, the employees' organization becomes largely a center for social activities and educational work, and is called upon only under very special circumstances to act in any true sense as a labor union.

An opposite condition to the preceding obtains in cases where there are serious antagonisms between the employers and the working forces. In such cases the company union may be accepted by employees as a doubtful half-loaf in place of that membership in, and representation by, a national union which they might choose if not subject to direct or indirect coercion by the employer.

To determine the relative proportion of cases in which these two conditions exist is a matter of extreme difficulty. So far as the confidential testimony of professional personnel managers may be accepted—and there seems no reason to distrust such evidence—about 50 per cent of the company unions exist, in effect, primarily as social and educational organizations, as the result of skilled executive and personnel work and of established relations of confidence and good will between the working forces and the employers. A further group, comprising about 25 per cent of such unions, functions with considerable regularity and with substantial effect in collective wage agreements, but with the "bargaining" conditioned by a tacit understanding that the general scale of wages shall be determined in reference to prevailing rates of pay in the locality and industry involved. And the balance, amounting to about 25 per cent of the total, represents an unstable transition stage between the antagonisms of the less settled employer-employee relations and the smoother workings of the more modern personnel methods.

Where Organized Labor Performs a Useful Service

Turning now to the elements which apply from the standpoint of nationally organized labor, the most basic of all is the fact that, even with the very genuine improvements which have taken place in working conditions during recent years, there are still many situations which approach the intolerable—and there is, furthermore, no certainty whatever that, with labor union pressure removed, there might not be a serious reversion from the better standards that have been established.

The present group of labor leaders are, in the main, experienced in the very unsatisfactory working conditions of a short generation ago. They believe whole-heartedly that national labor unions are a social necessity, and that, without them, further improvements in working conditions will be impossible, if, indeed, there would not be a rapid reversion to worse conditions. Their measures of the social importance of the national labor unions may be extreme—but even their most active opponents cannot deny that there are large elements of truth in their contentions.

Starting from the preceding basic conviction, the labor leaders as a group find themselves, however, almost immediately face to face with a typical human dilemma. They are, perhaps, better advised as to the basic economic facts than the average of our population or many of our business leaders. But their first need is power—the power of an adequate membership.

Labor Leaders Must Promise Too Much

If labor leaders were rigid moralists, they might say to prospective members, "We cannot properly promise to secure you wage increases, except in those cases where the employer is able, but fails, to pay a competitive market wage." Such attitude might be theoretically admirable, but the leaders in question would soon be replaced in office by other leaders who would promise more concrete benefits, with less regard for academic exactness of statement.

This thoroughly human quandary appears to be the source of most labor union difficulties. Labor unions cannot maintain memberships without creating imaginary grievances when adequate real grievances fail to exist. Labor leaders cannot lead if they do not believe, or force themselves to believe, that great injustices must be remedied.

The historic policy of the American Federation of Labor has been to avoid political action and to concentrate on the development of conciliatory and cooperative closed-shop relations with employers. There can be little question as to the basic sincerity of this policy—but, with few exceptions, it has completely failed, and it has failed at a time when employers were, perhaps, readier than ever before to deal reasonably and on understanding terms with their employees.

The reasons for this outcome have already been indicated. The national leaders, yielding to the quasi-political necessities of their situation, have aroused feelings, antagonisms and false hopes which, in the end, they could not control. From this background have arisen a variety of labor union excesses—graft, racketeering, sabotage, and violence—which the national leaders have often sincerely deplored, but only in part have been able to check.

However, as opposed to these efforts to prevent excesses, even the national leaders have felt an absolute moral right to demand that employers, in cases of final disagreement with striking employees, should not be permitted

(*Concluded on Page* 66)

Products and Processes

Appearing from time to time under this heading, brief descriptions of new materials and new processes in the ever widening metal-working industry will be presented

Normalized Sheets

SHEETS and tin plate said to have a finer grain structure are offered by the Bethlehem Steel Co. These are normalized in a furnace at higher temperatures than are possible with the box annealing process formerly used. It is claimed that the new sheets will stand a deeper draw than the former box annealed product.

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Bronze Welding Rod

MUCH experimental work has been carried on in the use of bronze welding rod for joining steel. The Linde Air Products Co. announces a new welding rod which, together with improvements in bronze welding technique, it claims will join steel parts with welds having tensile strength up to 60,000 lb. per sq. in. and ductility in excess of 30 per cent. It offers it especially for use in repairing broken steel castings.

• • •

Steel Grating

A NEW type of steel grating, offered by the Belmont Iron Works, Philadelphia, is said to have greater strength with less weight than the designs heretofore used. All bearing bars have a beveled cross-section. This grating is offered for floors, platforms, safety steps, and sidewalk openings.

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Non-Sparking Tools

FOR a long time a need has been felt for non-sparking metal suitable for wrenches, chisels, hammers, and similar tools intended for use in places where a fire or explosion hazard exists. Tools made of beryllium copper appear to fill this need. Hardened after hot working, tools which have been produced in the laboratories of the American Brass Co. show a strength of 155,000 lb. per sq. in., and if cold rolled, the final strength may be increased to 180,000 lb. This is ample, according to the manufacturers of nearly all wrench shapes, and the tools are free from sparking. Satisfactory cold chisels also have been made in the laboratory.

• • •

Steel Rails

STEEL rails with new and improved properties are offered by the Bethlehem Steel Co. These rails are put through a Sandberg-Oven process. After leaving the hot saws the rails are allowed to cool on the hot bed to a temperature of approximately 1000 deg. F. They are then charged into the hot zone of the oven where they are allowed to soak until the web and base equalize to the same temperature. The rails then pass slowly through a cooling chamber where very slow cooling, it is said, greatly reduces the cooling strains which are the usual cause of thermal cracks.

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Puts Flux at the Bottom

MOST fluxes are used on top of the metal and the reaction due to the heat and oxygen of the air is rapid. In other words the flux is burned up and dissolved in advance of pouring the heat and the only function of the burned flux is the protection afforded by the residual products of combustion.

In an attempt to produce a delayed combustion flux the Alliance Brass & Bronze Co. has developed a somewhat unusual method of fluxing. A flux material known as Coverall Flux is put at the bottom of the crucible or, in the case of an open-flame furnace, is distributed over the length of the furnace in a strip 4 or 5 in. wide. The metal is charged on top of the flux and when the charging is complete a quantity of burned core sand is added for preliminary protection. As the metal heats up and goes into a fluid state the flux begins to dissolve, a part of it burning up as it searches out the metal mass for oxides and free oxygen. The ash and slag gradually come to the top to form a covering which is claimed to be almost impervious. As the temperature rises the desulphurizing agent in the flux begins to dissolve and comes to the surface to combine with the sulphur content.

For this new flux and new method of application a more complete and sustained contact of the fluxing agent with the metal is claimed and it is also said that a smaller quantity of flux is required. In the open-flame furnace from 2 to 4 lb. of flux are recommended for each 100 lb. of metal.

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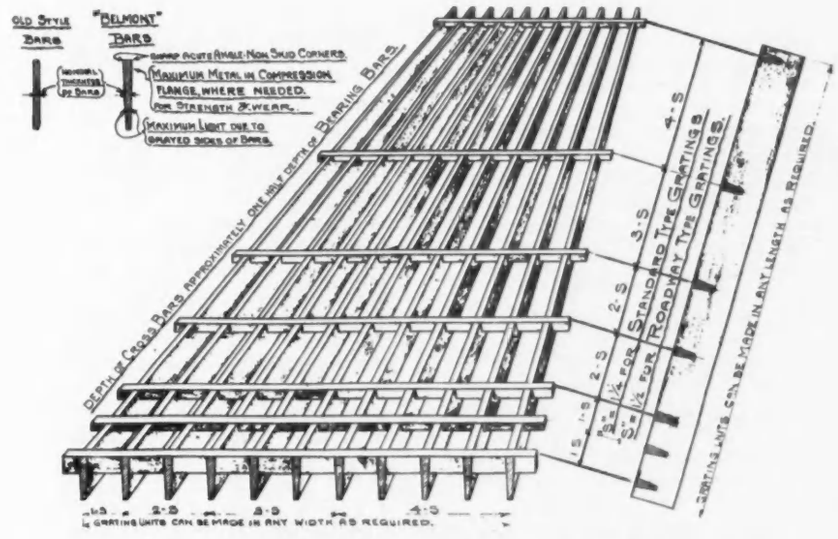
Spalling of Fire Brick

GRINDING fire brick on contact surfaces to prevent spalling is common practice in Europe and scarcely known here.



Greater strength per pound is claimed for this floor grating.

Steel

Fig. 1. Heavy toggle presses blank out and form the bowl-shaped half barrels.

THE repeal of prohibition has meant much to the metal working industry. Thousands of additional trucks have been put in service and the rush to build bars and appurtenances has created a heavy demand for alloy steel for trim and fixtures. New steel containers are being made for many products associated with the new liquor activity and one of these is the new type of insulated steel beer barrel described in this article. The barrels have the same shipping weight as the old type of wooden barrels. They have the same pitch lining on the interior and are offered the trade at very close to the price of the wooden product.

WHEN the Buhl Stamping Co., Detroit, decided to make barrels for the brewery trade, it first secured specifications from the U. S. Government and then went direct to the brewers for full details of their requirements. Nearly all of the breweries were found to have considerable handling equipment designed especially for the old type of wooden barrel and therefore it soon became evident that a steel beer barrel would have less sales resistance if it conformed closely to the shape and character of the wooden beer barrel.

In the final design, the Buhl barrel has an inner contour which exactly duplicates that of the typical wooden barrel. The company's 45 years of experience in drawing and fabricating steel containers helped in developing a type of construction which would give the strength necessary to withstand severe abuse. The chimes of the new barrels are made twice as thick as the outer shell and the heavily reinforced center band protects the barrel at the bilge. These two reinforcements are intended to receive the full shock no matter how the barrel is dropped. The taps are forgings said to be about twice as strong as the taps usually found on wooden barrels. The bung bushings are made with wide flanges so as to permit welding far enough away from the hole to avoid heat distortion. Incidentally, the smooth wide flange fits nicely into the racking gasket.

The barrel consists essentially of an inner and outer shell spaced about half an inch apart with the space filled with insulating material. The design is such that the thermal insulation is equal to that of the wooden barrel. Part of the scheme of insulation consists of wood pieces placed between the inner and outer shells at the top and bottom as indicated in the cross-section.

Welding is Important

The construction of the complete barrel leans heavily upon welding as a fabricating process and the large plant of the Buhl Stamping Co. is well equipped for all types of welding used in the construction of its various steel containers.

The department where the barrels are produced has been provided with conveyors and specially designed jigs to reduce the handling labor to a minimum. Heavy toggle presses blank out and form the deep bowl-shaped parts which are used in building up both the inner and outer shells. The bowls for the inner shells have smooth walls and rounded corners, and two of these are welded together to form the complete lining of the barrel. Into this lining are welded in place the taps and bung bushings. The welders doing this work are provided with quick-acting spring hook jigs and are served by an overhead conveyor system.

In order to duplicate the general shape of the wooden barrel and at the same time provide ample protection against abuses, especially designed heavy chimes have been added at top and bottom. These are assembled from two parts. One is a stamping and the other and heavier part is made from flat stock which is rolled and then welded to form a ring of the desired contour. The edge of the heavier top piece is turned over the edge of the stamping to give additional strength and better appearance. One complete chime assembly is roller

Supersedes Wood in the Construction of Barrels for Beer

welded to each outer bowl, one to the top bowl and one to the bottom bowl. This is accomplished on a semi-automatic machine.

Outer Shell is Pressed On

When the parts are all ready for completing the barrel assembly they consist of an inner shell with its fittings and the wood spacing pieces for top and bottom, the insulating material, the two complete outer shell bowls with chimes, and the center reinforcing ring. The outer shell bowls are then pressed over the inner shell with the insulating material in place between the two. This is a press fit and the units after leaving the pressing operation hold in place until the final welding makes the outer shell one continuous piece and thus firmly locks the whole unit together. The center reinforcing rings are spot welded to the outer bowl and the joints are finally torch welded to give full strength and to protect against leakage. Many other welding jobs are required in the production of the complete barrel. Two of these are welding the tap bushings and the bung bushings to the outer shell openings. After completion the barrels are tested against leakage, are inspected inside and out, and are then bonderized both inside and out. This is to produce a base which gives the proper adhesion for the pitch coating on the inside and the enamel on the outside. The enamel is applied with spray guns as the barrels revolve on roller supports.

Advantage of the steel surface is taken in producing a bright color scheme and the most popular design is in sharply contrasting colors. The most popular size is the so-called half

Fig. 2. Two steel bowls are welded together to complete the inner shell.

Fig. 3. A rather fussy job is the welding in place of fittings. Special quick acting jigs are provided.

Fig. 4. Revolving table supports are used for welding on the center band section.

barrel size, and for this from 80 to 90 lb. of sheet and strip steel in the flat are required, yet the shipping weight when the barrel is completed is just equal to that of the average wooden barrel.

Advantages of Steel Barrel

Some of the advantages claimed for the steel barrel against the wood are that it has greater strength, has a more attractive appearance, that full measure of contents is maintained, and that the upkeep is less.

The steel barrel, as stated, has the same pitch lining as the wooden barrel. It also is sufficiently close in size and shape to permit handling with existing wood barrel equipment. From the standpoint of sanitation, the steel barrel with its rounded corners gives less chance for fungus to collect and is easier to clean and sterilize. The first price of the steel barrel is approximately the same as the wooden barrel, but the life is said to be longer and therefore an over-all economy is possible.

Oxy-Acetylene Flame for Hardening*

THE application of oxy-acetylene hardening which has received the greatest publicity in this country is the hardening of rail ends. I believe the Chicago, Milwaukee & St. Paul Railroad was the first to do this in a large way. A hand welding torch is used to heat the rail end to a temperature above the recalescence point. The rail end is then quenched by pouring a definite amount of water on it. This leaves the rail end in an extremely hard and brittle condition. A second reheating with a hand welding torch reduces the hardness to the desired degree. The temperature for quenching is determined pyrometrically and the temperature of drawing is controlled by the simple expedient of heating until a piece of solder drawn across the surface will melt and slightly tin the steel. This process has the advantages that it can be done in track, that the apparatus is readily portable, and that the controls are suitable for use in the field by regular track-welding crews.

Heat Treating Rail Ends

A still further improvement of the method of hardening rail ends by the oxy-acetylene method has been put into practice during the past year by the Oxweld Railroad Service Co. It differs radically from the earlier method in the use of a very much larger oxy-acetylene torch and the elimination of the water quenching step with its second heating which is inherent in the process when water quenching is used. This new method depends upon the use of a sufficiently large oxy-acetylene flame so that the surface of the rail to be hardened can be brought to a proper temperature before the rest of the rail has been materially heated. Simple conduction of heat makes the cold rail metal act as the quenching medium and the rate of quenching is such that the rail is left automatically at the desired hardness.

A fact that may at first seem surprising, though not on second thought, is that the rate of quenching is for practical purposes independent of air temperature winds and other outside influences. In fact the method has been used with equally good results whether the surrounding temperature was 20 deg. below or 110 deg. above zero. This is of course due to the fact that the results are controlled principally by the heat conductivity of the metal and this is proportional to the difference in the temperature between the hot and cold metal. The steel must be heated above about 1400 deg. F. in order to be hardened, and when the hot metal is at this high temperature there is not a great deal of difference in the temperature gradient whether the cold metal is at 0 deg. or 100 deg.

Measurements taken in a great number of applications have shown that the Brinell hardness of the treated metal was increased about 100 points. For example, if the original hardness of the rail head was 260, the treated metal had hardness of 350 or better. The final hardness of the rail is controllable within certain limits, although the greater the surface hardness, the shallower will be the thickness of the hardened layer. The apparatus and the method have been applied successfully to both the head-free and the standard type of rail in sections ranging from 100 to 135 lb. per yard, and the pattern of the hardened area can be controlled almost at will. In various stretches of track that have been treated, speeds have been attained up to 60 or more joints per hour, and this speed is the chief reason for the economy of the operation.

The advantages of this process over other methods of hardening rail ends are its cheapness, freedom from complicated controls, the superiority of the technical results, and the fact that it is practically foolproof. The speed with which the operation is carried out leads to economy in gases and the crew is small, so the actual cost per joint is very low. Technically the degree of hardness can be controlled within desirable limits, and the nature of the operation is such that if the operator for any reason varies from the standard conditions which have been set for him the rail will be left in a safe condition, which would not be the case, for instance, if inadvertently the second drawing operation were not carried out on a rail that had been quenched from a high temperature.

This method of heat treatment depends on two things: the heat conductivity and the heat capacity of the metal integral with the part that is being heat treated. Both of these are inherent properties of the steel not subject to change but whose laws are understood and hence capable of direction. The heat conductivity of steel is sufficiently high so that this factor does not usually require special consideration. However, if there is a restricted portion between the steel that is to be quenchd and that which is to act as a quenching medium, complications may arise. Since the unheated portion of the steel is to serve as the quenching medium, it must bear such relation to the highly heated part that it can quickly absorb the quantity of heat above the recalescence point in the part that is desired to be hard. The balancing of these factors, that is, the quantity of heat above the recalescence point and the capacity of the rest of the metal to absorb heat, determines the rapidity of the quenching and hence the hardness of the part being treated.

Danger with Water Quenching

When steel is water quenched from a high temperature it is first converted into a hard, brittle condition known as martensite. The second heating or drawing operation converts this into sorbite or some other intermediate structure which possesses lesser hardness and greater toughness. Since there is a very appreciable difference in volume between steel in the martensitic and other conditions, a very severe strain is set up when steel is suddenly quenched, and especially so when the conditions are such that only a part of the whole object is left in the martensitic condition.

The system of heat treatment whose application to steel rail has just been described is the simplest and most logical method of avoiding extreme quenching and hence the difficulties that often follow when that method is used. The strains due to severe quenching are avoided and there is a gradual transition in the body of the steel from the normal unaffected metal to the localized hardened spot.

Application to Machine Beds and Dies

The method is applicable not only to rail but to many other steel parts, and has been applied to such things as lathe bedways, bearings on shafts, dies and many other parts. In these applications it has enabled the substitution of fabricated steel for iron or steel castings, has eliminated the

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* From a paper by J. H. Critchet, vice-president, Union Carbide & Carbon Research Laboratories, Inc., New York, read before the International Acetylene Association at Chicago.

Artist Joins Engineer in the Design of the Industrial Product

WE are just at the inception of the association of engineer and artist in American industry, according to Joseph Sinel, industrial designer, New York, who addressed the American Society of Mechanical Engineers on the subject at the annual meeting of that body in New York. What he had to say was in part as follows:

Buying habits and buying favor have undergone radical changes in the last few years. Buyers and users of products have acquired a sense of discrimination; they have suddenly become conscious of line, form, and color; they have been educated, largely through the mediums of the motion picture and advertising, to a finer appreciation of better things—at least better-looking products. Buying appetite is no longer satisfied with the commonplace. This has resulted in a subconscious association, in the mind of the consumer, of superior quality.

Literally hundreds of factories in the same field pour mass production into the same channels of distribution, to reach the same markets, to bid for the favor and dollar of the same consumer, with products of similar character, purpose, and price. When this is so, design alone is the factor of differentiation. Given two articles of similar utility and comparable price, the sales advantage invariably rests with the better-looking item.

One of the functions of an industrial designer is to bridge the gap between manufacturer and ultimate buyer of his products. Part of the designer's job is to present an item of inherent merit and utility in its most favorable light. In achieving this end, he must of necessity consider such factors of preference as convenience, utility, beauty, appeal, economy in manufacture and sale, competition, resistance, and price. Many of these points of influence originate with the manufacturer. Appearance, however, originates with the designer.

The products of industry are, for the most part, three-dimensional. Unlike illustrative art, industrial design must deal with surfaces, planes, their physical and optical aspects. How successfully these integral planes, or surfaces, are molded into a harmonious mass as a rule predetermines the success of design as an instrument to induce and to increase sales.

The industrial designer, while he does not profess to know engineering, often senses the appropriate mechanical application for the job. Admittedly he is an artist, a designer, yet his efforts reflect the sum total of the practical commercial phases of the problem as well as an aesthetic approach. His conception and expression of line, form, and color are natural evolutions of the requirements of the job.

Fortunately, mechanical products are not encumbered or greatly influenced by the normal concepts of art. Thoroughly utilitarian in character and purpose, they escape considerable conflict with the sort of opinionated art associated with luxury items. Stoves, washing machines, refrigerators, vacuum cleaners, for instance, have primary mechanical functions to perform. First, last, and always, they are products engineered to attain definite results. Over a period of years, they have been developed to a high point of mechanical efficiency. It is neither desired nor expected that the artist will radically alter mechanisms that are the result of years of experimentation and which are very creditable examples of our machine age. It is within the province of the artist, however, to improve the optical aspects of purely functional parts, and in so doing often contribute not alone to appearance but to convenience, downright utility, and manufacturing economy.

When we are dealing with functional devices and the limitations they impose upon the designer's efforts, then the utmost collaboration between engineer and designer is not only desirable but absolutely essential. In any such problem there are numerous factors to be reconciled, angles of approach to be satisfactorily treated, practical considerations recognized. In other words, a working basis should be established between the plant engineers and the designer.

Why the Artist is Needed

When we look at the products of industry, we see ample evidence of excellent designing talent on the part of the engineer. Indeed, the outstanding contributions in the way of significant form in products must be credited to the engineer and not to the artist. Then why the need for the artist in industry if the outstanding developments in exterior appearance are the work of the engineers? Simply because the division of labor has been extended. It is too much to expect the engineer not only to design the functional units and processes of a machine, but to give it adequate external form as well, because the engineer is not always an artist. Frequently the engineer is an artist, and then we can rely on him to provide his product with an exterior expression of good grace and proportion. The purpose of the artist in industry is not to usurp any of the engineer's functions, but rather to supplement them. The engineer thinks primarily of interior functioning forms, while the artist thinks in terms of externals. Consequently, if the engineer-designer and the artist-designer can coordinate their talents, we are likely to get better products in the future than we have done in the past.

Creep and Fatigue Tests of 18 and 8 Steels

THE effect of temperature on the properties of metals was the subject of a report of the joint research committee of the American Society of Mechanical Engineers and the American Society for Testing Materials made to the recent annual meeting of the American Society of Mechanical Engineers by H. C. Cross, Battelle Memorial Institute, Columbus, Ohio. The report covered a comparison of resistance to prolonged loading (creep) and to repeated stress (fatigue) of 18 per cent chromium, 9.5 per cent nickel, 0.5 per cent manganese and 0.6 per cent silicon steels of low and high-carbon contents, 0.067 per cent carbon in the one case and 0.125 per cent in the other.

Induction furnace heats, made by the Babcock & Wilcox Co., were poured into ingots for rolling and into castings. A summary of the results is as follows:

The room-temperature tensile strengths of the wrought materials were roughly a quarter higher than those of the cast materials, and those of the high-carbon lot somewhat higher than those of the low-carbon. In both fatigue and creep tests, high-carbon wrought was at the head and low-carbon at the foot of the list in load-carrying ability. Carbon had a strengthening effect on creep and fatigue resistance of these steels, in line with published information.

The order of strength of the materials as shown in room-temperature tests carries through the high-temperature tests, wrought material being stronger than cast, though the creep resistance of the two is not very different at 1200 deg. F. The generalization sometimes stated that coarse-grained cast material has superior creep resistance to fine-grained wrought material is not borne out in this case. Such comparisons should state the type of material and the temperatures for which they are made. In creep tests, the cast materials were characterized by higher initial deformation than the wrought. Some bars of cast high-carbon fractured in creep tests with very little elongation.

Contrary to the general opinion that all "unstabilized" 18-8 of carbon content over 0.02 per cent shows embrittlement as judged by room temperature impact tests after sojourn at 1100 to 1400 deg. F, the low-carbon

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Die Casting,

IN choosing between a die casting or a stamping for a specific design, there is no infallible set of rules to determine selection. Each, in various cases, has its points of advantage.

However, there are very definite areas of supremacy for both the die casting and the stamping, and the author, in this article, points this out. His purpose is not to discourage the use of stampings, but to show cases in which the use of die castings have been indicated.

WHEN low-cost parts are a consideration, the modern designer of metal products in the small and medium-size range usually turns to the die casting or to the stamping. Production costs are low, yet it is well known that either type or part, when properly designed and produced from metal of proper composition, is not only satisfactory, but exceptionally well fitted for a wide variety of applications.

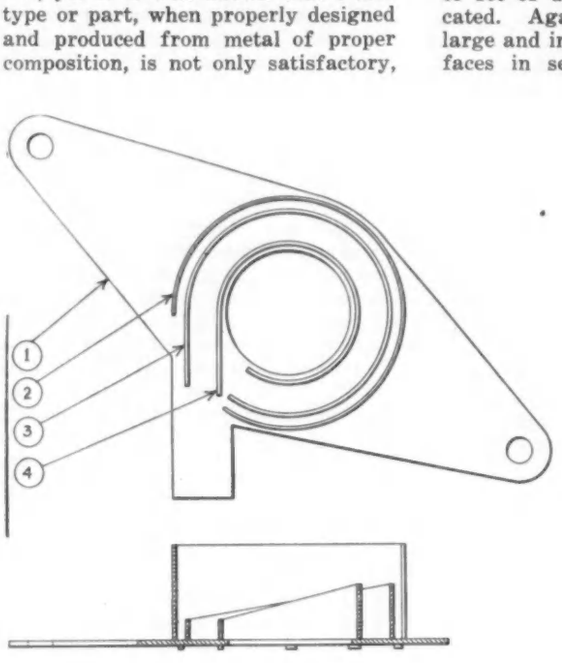


Fig. 1. Machine element assembled from four separate stampings.

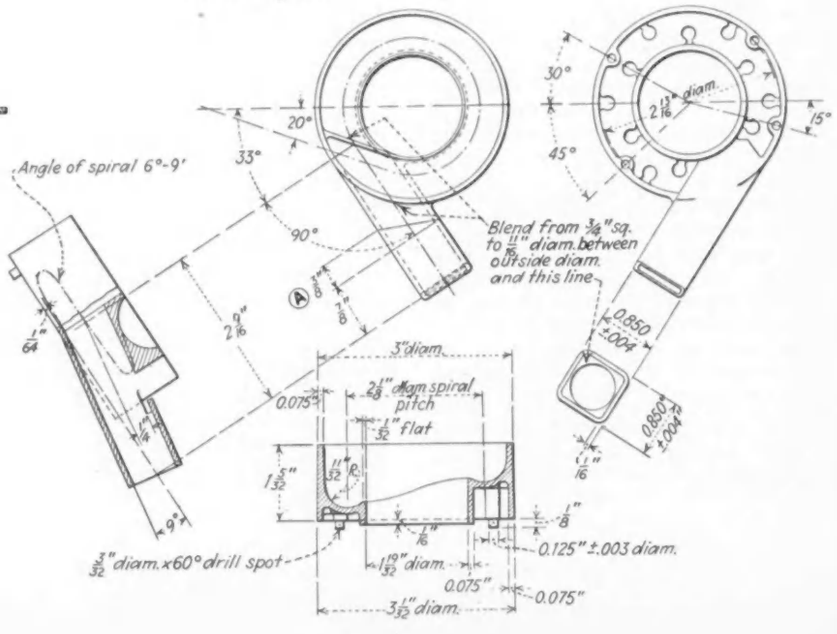
Fig. 2. One-piece die casting substituted for the stamped assembly shown in Fig. 1. (Drawings, courtesy of Doehler Die Casting Co.)

It is not so generally known, however, that, for certain classes of parts which may be produced by either means, the die casting is often the less expensive per piece as well as for tool equipment. There are several reasons for this, and they do not apply to all sets of conditions. Moreover, there are many applications in which stampings are better suited than die castings, whereas the reverse is also true in perhaps an equal number of cases. In still other instances, the two are combined with best results.

Any attempt to formulate hard and fast rules to govern the selection of one or the other product is difficult and likely to involve numerous exceptions. Granting this fact, it is still possible to make certain helpful suggestions which the designer may follow with discretion, realizing that special sets of conditions may sometimes alter the entire picture or bar either type of product.

Generally speaking, if the part required is flat and of uniform thickness so that it can be turned out in a simple blanking and piercing operation, without a separate forming die or set of dies, the stamping is indicated. Again, if the piece is quite large and involves very extensive surfaces in sections thinner than can be cast in this form, as for example, in an automobile door panel, a stamped part is almost certainly the solution. If the piece is to serve as a spring, where repeated flexing is required or where spring pressure must be maintained; or if it is to be stressed in other ways in which a casting could not be expected to stand up, the latter is quite obviously barred. There are also a great variety of small parts, such as are readily formed at a high rate of speed in dieing machines or other special forms of punch presses with which the die casting can hardly hope to compete.

Applications such as these and others which might be cited are quite evidently produced to best advantage in the stamping press. When it comes to parts of moderate size which, if stamped, would require separate forming dies and perhaps one or more assembly operations, the die casting usually deserves serious consideration. Again the question of section thickness, metal strength, surface finish, possible waste of metal and other factors must be weighed. But it is certain that many parts now stamped, formed and assembled could be produced in the same or more satisfactory form by die casting, and at a lower cost. This will be made clear by a consideration of certain specific



or Stamping?

By HERBERT CHASE
Consulting Engineer

cases, but before this is done, some outstanding advantages of the die casting deserve mention.

Some Die Casting Advantages

Parts having a wide variation in section thickness are readily produced, and this often makes for maximum economy in metal. Stiffness is readily secured and integral bosses, rivets, studs or other fastening means are easily provided. Many products which, if stamped, would require several parts each involving separate dies, as well as handling and assembly costs, can be die cast in one piece in a single die and with no assembly operations involved. Dimensions can often be held within closer limits with the die casting than with the stamped part. As a rule, die costs, especially for zinc-base die castings, are lower than for stamped parts in which forming dies are required.

made unless at least a few thousand parts are required.

In general, the stamped part has thinner sections than the die casting, but for the same reason the casting is likely to be stiffer. It should be remembered also that small die castings with a wall thickness of 0.030 in. or less are occasionally made, and quite large castings with walls only 0.050 to 0.060 in. are not now uncommon. Die-cast parts can therefore be made of very light weight. They can also have cast threads, whereas the stamping must usually be machine-threaded or have a separate screw-machine-threaded part fastened to it. Soldering, riveting, clinching or staking operations are often needed on the stamping, but are seldom required on the die casting. Integral shaft bosses are possible in die castings, whereas with the stamping, attached bearing bosses, formed as separate pieces, are usually required for a turning shaft.

On the score of die costs, the die castings for a given assembly are often formed in a single die, whereas the stamped assembly, besides requiring more parts, usually means one or more separate dies for each part as well as separate setup and often higher maintenance costs. It is true, however, that the die casting often involves separate shaving dies for cleaning, but only when such dies result in a saving over hand cleaning. Fin removal involves some expense in the case of the die casting, but burrs on stamped parts also demand removal in some instances. Tumbling is often used to advantage for this purpose in both types of product.

Finishing sometimes costs more and sometimes less with the die casting than with the stamping. The latter can often be made from ready-finished stock, but if drawing operations are required and polishing is necessary prior to plating, the stamped part

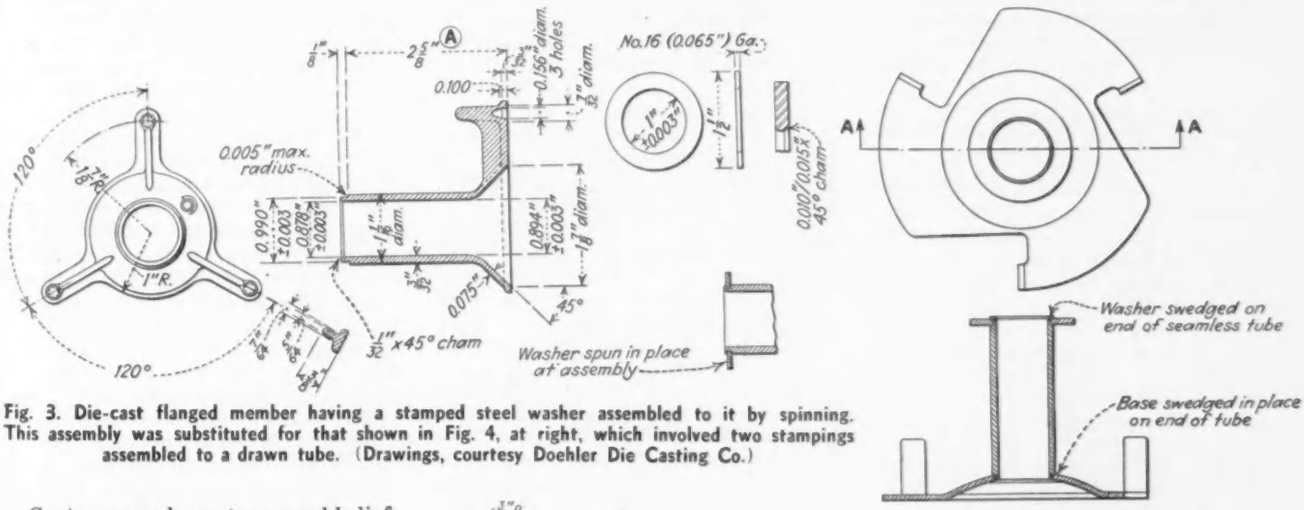


Fig. 3. Die-cast flanged member having a stamped steel washer assembled to it by spinning. This assembly was substituted for that shown in Fig. 4, at right, which involved two stampings assembled to a drawn tube. (Drawings, courtesy Doehler Die Casting Co.)

Contrary, perhaps, to general belief, there are many pieces in which it pays to construct a die for die casting even when a few hundred parts are required. One instrument maker, for example, has found it economical in some instances to make a die for less than a hundred parts, and one of the largest die-casting dies used by an automotive manufacturer is for a part of which only 400 to 500 die castings are required per year. Much depends, however, upon the complexity of the die. Dies for intricate pieces, requiring several slides and difficult core construction, are not commonly

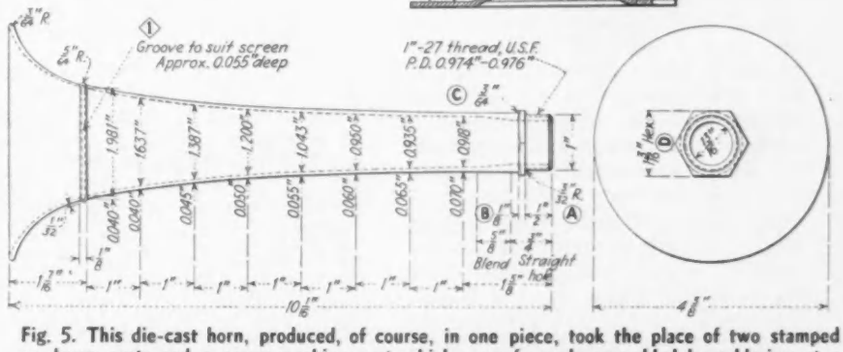


Fig. 5. This die-cast horn, produced, of course, in one piece, took the place of two stamped or drawn parts and a screw-machine part which were formerly assembled by soldering at a considerably higher cost. (Drawing, courtesy Schultz Die Casting Co.)

may show a rippled surface and is likely to go out of shape when buffed. The same is not true of the die casting. It may require a little more buffing, but if produced with the smooth surfaces now obtainable in high-grade die casting, the buffing is quickly and cheaply effected and warpage rarely occurs.

Cleaning and Finishing

Many stampings involve a considerable metal waste in flash and cut out areas which is largely avoided in the die casting. The latter involves, of course, sprues, gates and flash, but these are cut off and remelted with very little loss in most instances.

On the score of variety of alloys available, the stamping has an advantage, especially as a great number of ferrous alloys are available. The latter, as well as some of the copper-base and other alloys, are usually stronger than die cast material, especially in tension, bending and impact strength. Nevertheless, adequate strength is available in the die-casting alloys for most purposes. Zinc-base alloys run from about 36,000 lb. per sq. in. tensile strength to about 47,000 lb.; the aluminum-base type from about 29,000 to about 36,000 lb., and the copper-base type from about 65,000 to about 95,000 lb. Copper-base die castings are not yet very widely used, but are produced on a commercial scale and are not subject to the season-cracking sometimes met with the copper-base stamping.

To illustrate some of these general statements, a few specific applications may be cited. The machine part shown in Fig. 1 is a stamped assembly comprising a flange with several holes and three other formed stampings with lugs or keys which mate with corresponding holes in the flange and are bent over to fasten the respectives pieces to the flange. Each of the formed parts had first to be blanked, after which they were shaped as shown. The assembly was used to return a ball to a certain location in a machine. It proved difficult, with stampings, to maintain the desired accuracy and the cost of the several dies required was considerable, although all are for relatively simple parts. Assembly also involved an added expense, as did the handling of the individual parts.

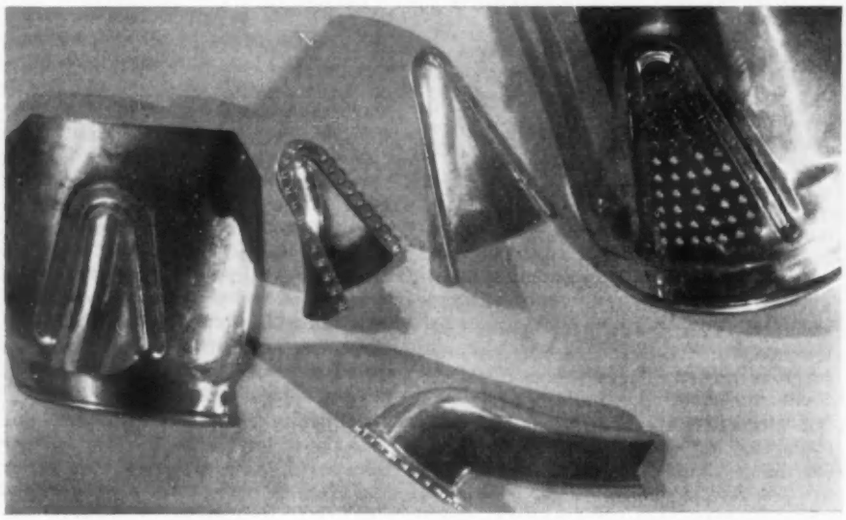


Fig. 6. At the left are shown part of an aluminum coffee pot and the stamped spout which was formerly attached to the pot by a clinching operation. At the right is a die-cast aluminum spout with integral rivets and a portion of a coffee pot to which the spout is attached by clinching the rivets in a single blow, making a tighter and more secure joint. Above (in center) is a die-cast tea-kettle spout with integral rivets, made and attached in the same way as the coffee-pot spout. In these instances formed and spun parts are combined with die castings to good advantage. (Courtesy, the Enterprise Aluminum Co.)

In Fig. 2 is shown the die casting which was substituted and resulted in considerable saving. It is made in one piece and in practically finished form in a single operation aside from cleaning of fins. It also incorporates a square extending tube which could not be included in the stamped assembly without extra operations and integral fastening lugs or rivets which do away with the flange and with the separate fastening means for holding the stamping to the machine. The groove is also a true spiral, which was not obtained in the stamped assembly, and the finished part is a workmanlike product which is stiffer and better in every way than the stamping.

Fig. 3 shows another die casting which was substituted for the stamped assembly, Fig. 4, consisting of a drawn tube and two flanges which were swedged to the tube. Besides the operations involved in drawing and cutting off the tube and swedging it, there was the cost of the stamping and forming dies for the other parts, and of the stampings made in them. The die casting requires only one die, is more rigid and a better looking product, and in addition, is readily held within closer dimensional limits, which give a closer fit with mating parts. In this case, the hot-rolled steel washer is retained and is fastened to the die casting in a simple spinning operation. The washer could be used as an insert and be die cast in place or an integral flange could have been cast in its stead, but would have involved a more expensive die.

The horn projector shown in Fig. 5 was formerly a composite assembly involving a stamped bell of sheet metal, a drawn tube and a threaded screw-machine part, all of which were assembled by soldering. It is now a one-piece zinc-base die casting which not only looks better and costs very much less, but has greatly superior tonal qualities. It is very easily buffed, polished and plated, and has no tendency to go out of shape when these operations are performed. Of course, only one die is required, and no screw-machine work is needed, as the thread is die cast. The only machine work aside from removal of the fins and buffing is to turn the groove for a screen near the inner end of the bell. Although the die casting doubtless weighs a little more than the stamped and drawn product, it is considerably more rigid and affords the other advantages cited.

A final example is found in the coffee pot and the tea kettle spouts shown in Fig. 6. These spouts were formerly stamped or drawn and were fastened to drawn bodies of the utensils by clinching operations. The result was an insecure fastening which was apt to result in a leak at the joint, especially if the spout was struck in service. As the material used was aluminum, and the metal of rather light gage, neither soldering nor welding was feasible, at least within the cost limits permissible. By die casting the spouts, however, and forming integral rivets on the attaching flange (as was done with practically no extra expense in the casting operation), a secure fastening, which could be effected by a single blow in a riveting press, and a leak-proof joint were formed. In this instance, the stamped spouts were probably somewhat less expensive in themselves than the substituted die-cast spouts, but the better final result secured undoubtedly justified whatever small difference in cost was involved.

Many other comparisons, some of which might be less favorable to the die casting, might be cited. Those chosen were selected as being in a class wherein the die casting possesses advantages that are likely to be overlooked. As already pointed out, the stamped part has many applications in which its superiority is unquestioned, cost considered, and the same is true of the die casting. Both deserve study in many cases, and until such study has been given, the designer cannot always be sure that he has selected the type of construction that is least expensive and otherwise best suited to his needs.

Rotary Hobbing Machine Features Flexibility and High Production

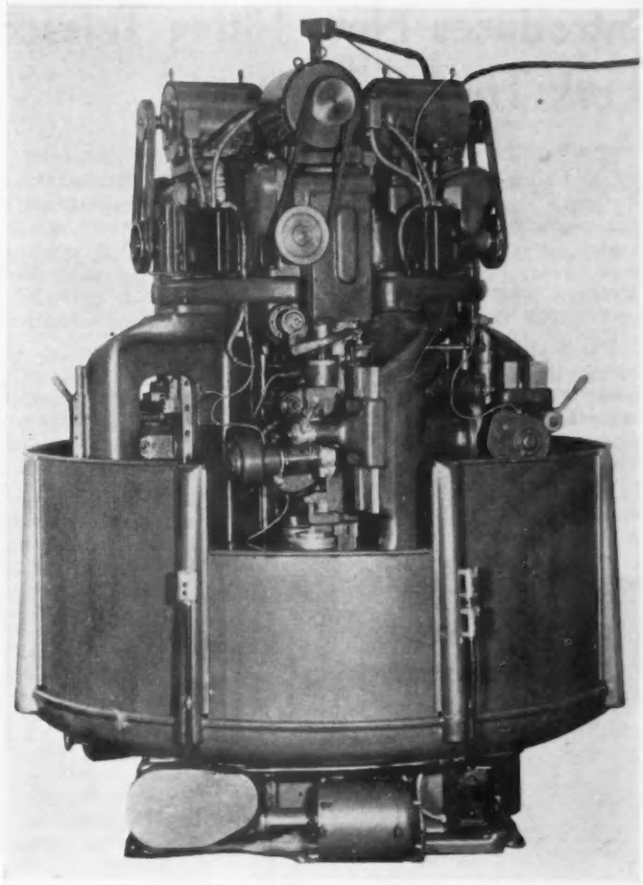
THE Lees-Bradner Co., Cleveland, has developed a new heavy-duty rotary hobbing machine of unique design. Increased production with lower cost per piece is featured, and also flexibility, the machine being adapted for hobbing spline shafts, worm wheels, and spur or helical gears—right or left-hand and angles up to 45 deg. It will take gears up to 7-in. outside diameter, 9-in. face, and pitches up to 4 DP in steel.

In operation the machine represents a departure in hobbing machines, in that each unit functions independently; if rotation of the table is stopped each unit will complete its cycle of operation and hob slide will return to starting position before power is automatically cut off, and each unit will come to a stop at completion of cut.

The unit construction consists of four, six or eight hobbing units, each with individual constant-speed motor drive and independent hob feed and speed changes, mounted on a rotating table, which is actuated by a separate 2-hp. constant-speed motor through worm and worm wheel. Rotation of the table can be timed from 1 r.p.m. to one revolution in 16 min., through pick-off gears. Another feature is that it is impossible to start the table rotating without first starting the lubricant and coolant pumps, which safeguards both the work and the machine from damage from lack of lubrication during cutting operation.

Another feature is that several different jobs can be handled simultaneously, each unit can be arranged to take a different job, and if necessary, where one job requires more time than another, this particular unit can be set to revolve twice around the table to allow enough time to complete the operation while the other units are completing two pieces. In short, the machine can be arranged to handle a series of different jobs, using only as many spindles as necessary to obtain maximum production in the shortest possible time.

The machine is fully automatic. Power input is through a circular collector at the top of the machine, and the driving motors on the separate hobbing units are automatically controlled by travel limit switches which start each motor after passing the loading position and stop each motor after the cycle of operation is completed and before reaching the loading point. The operator merely loads and unloads the work spindle. Two push buttons control the starting and stopping of the machine—one handles table rotation—the other starts pump motor and stops both the pump motor and rotation of table.



Each of the four, six, or eight hobbing units functions independently. Several different jobs can be handled simultaneously, and where one job requires more time than another, the particular unit can be set to revolve twice around the table.

Lubrication is by means of a "cascade" system, filtered oil being pumped to a receptacle at the top of the machine and flowing by gravity to the various bearings and gear boxes, then back to a reservoir in the base. Cutter coolant is pumped to a separate reservoir at the top and flows in volume by gravity through a flexible hose to the cutter. A 1-hp. motor drives both pumps.

The work spindle has a No. 14 B. & S. taper hole and is driven through hardened and ground worm and very accurate index gears with index changes through pick-off gears. Floating anti-friction bearing mountings are provided on both work spindle and hob spindle to allow for expansion. The tail-block is raised, lowered and locked by a single lever, moving in one plane only.

The rotating table, carrying the hobbing units and driving mechanism, is mounted on a substantial base and the entire active weight is supported on a large Timken roller bearing having a rated capacity of 50 tons. The outside diameter of the base of the four-spindle machine is 8 ft. 3 in. and of the six and eight-spindle machines, 9 ft. 4 in. Overall height of all machines is 115 in. The base is surrounded by sectional removable splash guards with a lower guard at the loading position where units are inactive. Ample chip room is provided.

Boiler Shop Drill of Rotary Type

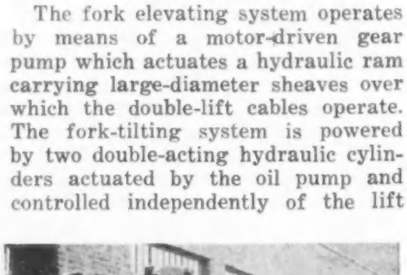
A NEW Thor rotary type boiler shop tool with drilling and reaming capacity up to 1¼ in. has been added to the line of the Independent Pneumatic Tool Co., 600 West Jackson

Boulevard, Chicago. Rapid and smooth operation in staybolt tapping and flue rolling is claimed. The machine is equipped with power blades instead of connecting rods, pistons and crankshafts. Governor controlled air consumption and speed is emphasized as preventing the motor from racing when starting the tap. The tool has a speed of 210 r.p.m. It is 12 in. long and weighs 28 lb.

Introduces New Tilting Telescopic Fork Truck

FEATURES contributing to safety and speed of handling, and economy of operation and maintenance, are embodied in the type "T.T.T." model A(S) 1002-1 tilting telescopic fork truck, being announced by the Mercury Mfg. Co., 4118 South Halsted Street, Chicago.

The fork elevating system operates by means of a motor-driven gear pump which actuates a hydraulic ram carrying large-diameter sheaves over which the double-lift cables operate. The fork-tilting system is powered by two double-acting hydraulic cylinders actuated by the oil pump and controlled independently of the lift



system. Action is smooth and easily controlled for either fast or very slow movement and accurate positioning of the forks. The hydraulic system conserves battery power, because gravity lowers the load. It requires no brakes and is self-lubricating. A definite cushioning of the load in all positions is obtained, and the hydraulic system includes an automatic and positive overload protection.

The heavy-duty vehicle type drive motor is mounted directly on the drive axle in a unit assembly. Drive is through double reduction bevel and spur gearing, and the housing is provided with top and bottom covers and capped bearings for ready accessibility. Ball bearings are used throughout. Both the drive motor and the pump motor are accessibly mounted.

Spring-applied, internal self-energizing type brakes of large area are mounted within the drive wheels. Location in the drive wheels provides maximum safety and avoids racking strains upon the drive gearing. Brakes are electrically interlocked with the controller to cut off power when the brakes are applied.

Drive control is the Mercury quick-acting magnetic contactor system with manually - operated master switch. Destructive arcing and burning contact fingers are said to be eliminated and controller maintenance greatly reduced. The hoist motor is operated through a similar magnetic contactor system.

The steering wheels of the truck are provided with a semi-elliptic cross-spring mounting to cushion the frame and battery loads. Wide steering pivot forks, ball-bearing mounted, give short turning radius and easy handling.

The telescopic tiering truck, illustrated, has a carrying capacity (for 36-in. platen) of 3000 lb. and may be provided with forks of length, width and thickness to suit the loads. Fork-spacing is adjustable. The forks are capable of tilting forward 15 deg. and backward 2½ deg. The maximum fork-lifting height is 109 in. and the clearance height of the uprights with forks lowered is 83 in. This clearance permits operation through doorways 7 ft. high or higher, and the telescopic lift allows piling of uniform pallet loads to a height of 18 ft. The outside clearance radius is approximately 74 in. and the truck is capable of right-angle piling from a 114-in. aisle.

These trucks will be available in a complete range of models, including tilting and non-tilting, non-lift, high lift and telescopic high-lift models, and with hydraulic tin plate clamp, ram, chisel, or any type of forks for pallet handling. Capacities range from 2500 lb. to 5500 lb.

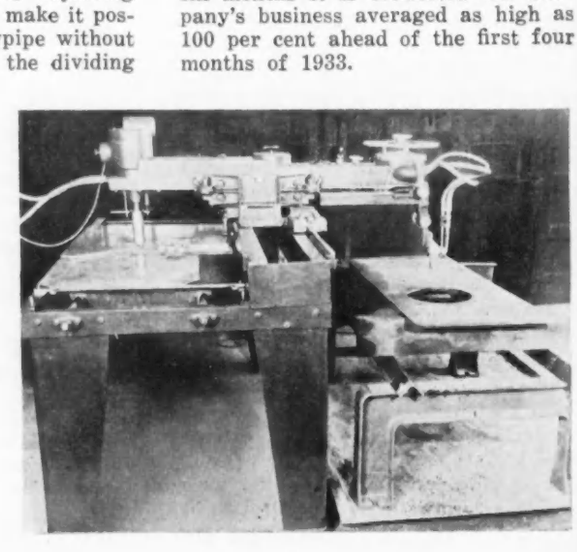
Precision Oxy-Acetylene Shape-Cutting Machine

VERSATILITY and precision feature a new stationary Oxweld cutting machine, designated as the Pantosec, brought out by the Linde Air Products Co., 30 East Forty-second Street, New York. With a cutting range of 44 in. longitudinally and 20 in. laterally, it does straight-line cutting, angle cutting, beveling, circle-cutting and intricate shape-cutting, and being a precision shape-cutting machine it is suitable for cutting dies, cams and other parts requiring a smooth and accurate cut. Floor space of only 72 x 83 in. is required for the machine.

The machine can be operated with a minimum of attention from either the templet end or the blowpipe end, as a hand-guided or as a machine-guided instrument. Angles can be cut without templets, since the cutting head can be locked for travel in any direction. Bevel-cutting is simplified; the provisions for adjusting the machine to the work make it possible to line up the blowpipe without shifting the work; and the dividing head enables the operator to set stops on work that is to be cut in several directions. An extension so mounted as to be always steady and secure makes it unnecessary for the operator to return to the back to start the profile cutting after the entry cut has been made.

The carriage of the machine is mounted on three-point supports. Piping for the gases is inclosed in the carriage, and all drives are protected by dirt-proof casings. All wiring is concealed, and the switches and controls are clearly labeled and easily accessible.

Joseph T. Ryerson & Son, Inc., Chicago, has declared a special dividend of 25c. a share, the first payment in two years. This action marks the restoration of Ryerson's operations to a profitable basis. During the last six months it is estimated the company's business averaged as high as 100 per cent ahead of the first four months of 1933.



Straight-line, angle, bevel, circle and intricate shape cutting is done by this oxy-acetylene cutting machine. The range is 44 in. longitudinally and 20 in. laterally.

Eccentricity of Load in Helical Springs

A TWO-YEAR investigation at Lehigh University, Bethlehem, Pa., of the eccentricity in helical springs under compression was reported on at the annual meeting of the American Society of Mechanical Engineers in New York, by J. B. Reynolds, professor of mathematics, and J. F. Houser, research associate, Lehigh University.

A machine built for the tests consisted essentially of a platen supported at the vertices of an equilateral triangle. Springs to be tested were centered on the platen over the midpoint of the triangle and loaded axially by a lever system. The points of support were ball bearing upon a point, a groove, and a surface. Loads at the supports were determined by readings on Ames gages on calibrated U-springs.

Tests of the machine showed that the ball bearings did not move over 0.005 in. under the loads applied and that the eccentricity could be determined within about 0.02 in. The machine was designed for axial loading of the spring, with freedom of rotation at the point of loading. It also prevented tipping or sliding of the spring. From readings taken on the gages at the points of support, the line of application of the equivalent single load, and thus the eccentricity of the loading transmitted from the spring to the platen, was obtained.

The springs tested were of the following specifications: mean diameter, 3 in.; wire diameter, 5/16 in.; free height, 8 in.; active coils, six or six and one-half; dead coils, two at each end; closing load, 400 lb. Three springs of these specifications were obtained from each of two manufacturers. Two springs of each set were used for test specimens and the third as a check. The springs were tested for eccentricity from an initial 50-lb. load to a 400-lb. load by increments of 50 lb., for varying amounts of dead end coils and for ground and unground ends.

The desired number of dead coils was obtained, in the case of the first pair of springs tested, by sawing off one-eighth of a dead coil from each end between test runs. For the second pair this was increased to one-fourth dead coil from each end. After the pieces were cut from the dead coils, in each case, the spring was tested, and the results were recorded as with unground ends. The ends of the spring were then carefully ground parallel to each other until there was almost, if not quite, a complete circle of bearing surface. The spring was again tested, and the results were recorded as with ground ends. In this way the eccentricity of each spring was studied from the condition with two dead coils at each end to that with no dead coils.

Results of the investigations in general seemed to justify the following conclusions:

1. An inherent eccentricity can be expected in all springs designed for axial load even if carefully manufactured.
2. The eccentricity decreases with the load, at least until the spring begins to nest at some points.
3. The eccentricity, in general, increases with a decrease in the number of dead-end coils. There seems to be a tendency to a maximum eccentricity for a given load when the free ends of the dead coils are diametrically opposite each other.
4. There is little appreciable difference in regard to eccentricity between the behavior of a spring with ground ends and one with unground ends.
5. Variations in eccentricity with varying end conditions decrease with increase in loads; that is, springs working under heavier loads are less affected by end conditions, in regard to eccentricity, than with lighter loads until nesting begins.
6. Although the eccentricity decreases with load, the stresses, in general, increase because of the increase in load.
7. Stresses are increased generally for a given load by a decrease in the number of dead-end coils. This indicates that dead-end coils are helpful in decreasing stresses in helical springs.
8. As the load on a helical spring under compression is increased, the point of eccentricity approaches a limiting position near the axis of the spring in approximately a straight line.

Sir Robert Hadfield Reviews Metallurgical Progress

THE personalities that are linked with the rise of metallurgy were engagingly set down in an unusual address of welcome which Sir Robert A. Hadfield made to the Iron and Steel Institute when it visited Sheffield, England, last September. This address, in the form of a profusely illustrated volume of some 110 pages, has apparently been privately printed by Sir Robert (22 Carlton House Terrace, London, S.W.1, England), and presumably a copy may be had on request, especially by those who are collectors of Sir Robert's writings and wish to secure this special historical record.

The book is naturally devoted largely to the part taken by Sheffield in the manufacture of steel, but there is an international purview in the references to both the early days and the modern achievements in metallurgy and metallography. The contributions of the Hadfield works through the years, and particularly in the war, including the manganese steel that finally became the material for trench hats, are properly spoken of, seeing that these works are a feature of the industries of Sheffield.

Final Coke Figures Show Sharp Decline

FOR the third consecutive month, November production of coke showed a declining tendency. The output of both beehive and by-product coke totaled 2,437,397 tons, or 81,722 tons per working day, which represents a decrease of 3.9 per cent in comparison with the daily production rate in October. The November daily average was 15.7 per cent under the year's high average of 96,919 tons recorded for August.

Production of by-product coke for the 30 days of November amounted to 2,344,597 tons, or 78,153 tons per day, the lowest daily rate reported since June. The decrease was entirely at furnace plants, whereas merchant plants reported an increase of 0.8 per cent. The cessation of labor troubles in the coal fields of western Pennsylvania was responsible for an increase of 106.2 per cent in the production of beehive coke during November.

Canadian Pig Iron Output Rises Sharply

NOVEMBER production of pig iron in Canada amounted to 29,592 tons, which was the highest output reported since July, 1931, when 40,303 tons was made. Production in October was 27,002 tons, and November, 1932, output totaled 14,149 tons. November output of steel ingots and castings was 43,099 tons against 48,496 tons in October and 37,088 tons in November, 1932.

H. A. Brassert & Co., Chicago, have received an order from Republic Steel Corpn. for the rebuilding of two Brassert gas washers into high efficiency cyclonic static tower washers with the installation of ceramic materials at the Buffalo plant. A 12-in. Brassert automatic strainer which will clean the water ahead of the spray nozzles for these two washers has also been ordered.

Non-Ferrous Castings Made Under Pressure in Plaster Composition Molds

A PROCESS of making non-ferrous castings under pressure in plaster composition molds has been developed by the Art in Bronze Co., Inc., Cleveland. This method is being applied in the manufacture of bronze, brass and aluminum castings, and is intended particularly for use in producing castings for ornamental work.

The process, in its general principle, is similar to die casting, being described as occupying a position midway between the die casting and sand casting methods. The metal is forced into the mold under slight air pressure, the amount of pressure depending on the type of casting. The casting temperature is considerably lower than in making sand castings, the metal being forced into the mold in a semi-molten condition, the temperature and the desired plasticity of the metal depending on the type of casting and thinness of section.

As the face of the mold is smoother than that of a sand mold and the molten metal is forced in under pressure rather than by gravity, the mold cavities are completely filled and the density of the casting is increased, resulting in castings that are claimed to be superior to sand-molded castings.

The process, it is stated, is particularly applicable to pattern castings and match plates, as it eliminates most hand filing and scraping. Thus not only is considerable labor saved, but it is claimed that the finished pattern equipment will be more accurate, as no distortion is caused by molding or detail lost in filing. In the production of a match plate bearing eight patterns it is the common practice to produce one wood master pattern, then cast, clean and gate seven white metal patterns, make the match plate castings from these and finally clean the match plate by filing and scraping. A certain amount of detail, it is pointed out, is lost in these various operations. By the new method only one wood master pattern is needed, and from this all units on the plate are made directly and the match plate casting will bear eight patterns that are accurate and require very little finishing. Gated patterns, single and multiple core boxes and core dryers also may be made by this method.

The primary purpose in developing this process was to assure accuracy. Not only has this been obtained, it is claimed, but the completed match plate costs less than by the old method, due to the saving in labor in cleaning the castings. It is not claimed that the process will compete with die castings or that it is applicable to the general run of foundry production in sand molds. However, its use is said to be advantageous in production work in many cases where castings better than those made in sand molds are desired. While the production costs are slightly higher than in the sand mold process, the increased cost often is justified considering the additional accuracy and saving in finishing costs.

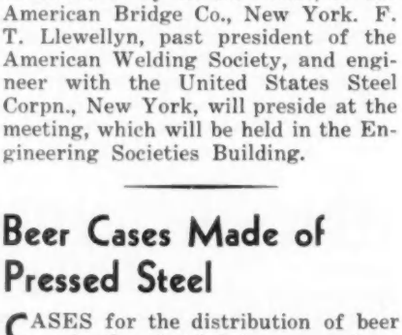
In making castings of an ornamental nature for architectural and other purposes it is stated that a casting can be made by this process that is an exact reproduction of the modeler's handiwork, regardless of how delicately the job may be modeled.

Welding of the Outdoor Mercury-Steam Plant

THE part that electric welding took in the construction of building, boiler and piping for the mercury boiler plant at Schenectady will be discussed in New York on the evening of Jan. 9 in a joint meeting of the American Society of Mechanical Engineers and the American Welding Society. A paper on the boilers, piping and equipment of this General Electric outdoor power installation will be presented by R. H. Rogers, of the General Electric Co., and one devoted to the building structure will be delivered by H. M. Priest, of the American Bridge Co., New York. F. T. Llewellyn, past president of the American Welding Society, and engineer with the United States Steel Corpn., New York, will preside at the meeting, which will be held in the Engineering Societies Building.

Beer Cases Made of Pressed Steel

CASES for the distribution of beer and other bottled beverages have been added to the pressed steel products made by the Truscon Steel Co., Youngstown, Ohio. These cases are of heavy gage steel with vertical ribs and embossed panels on the four sides. The tops are reinforced with steel rods and the corners are smooth and round. Sides and ends are of copper bearing steel. All joints are spot welded.



The cases are supplied with or without self-latching covers, also with or without steel separators of permanent or removable type or with corrugated cardboard separators. Bottoms are of ribbed steel with drain holes, open steel rods or replaceable wood. The cases are made in plain steel, hot dip galvanized or paint finishes or enameled in green, red or brown. Sides anh ends are embossed with trade names.

Gall-Proof Heavy-Duty Thread Dope

OF INTEREST to heavy-duty machinery manufacturers and users is a new metallic lead thread lubricant, recently placed on the market by Armite Laboratories. It is claimed to be of great value in the assembling of machinery and in the repair of equipment that is subjected to heavy duty, high temperatures and general abuse.

The makers describe the product as being a very finely divided metallic lead in paste form, and claim that in use a film of metallic lead is formed between the threads that prevents galling, speeds up repair work, and cuts costs. Stud bolts on the heads and exhaust manifolds will not freeze, nor will pipe threads corrode together, regardless of time, as the lead does not oxidize or harden.

The makers also claim this lubricant used on liners and fly-wheels facilitates their insertion or removal. All press work is said to be improved by the use of this lubricant. It is claimed that even a bright red heat does not harden or destroy the compound in the threads, making it an ideal dope for exhaust studs. The Armite Laboratories are located at 1900 East Sixty-fifth Street, Los Angeles.

Basic Bessemer converters installed in 1929 at the Hoesch Köln Neuessen Co. at Dortmund, Germany, were described by W. Broel and A. Dittmar in *Stahl und Eisen* of July 20, 1933. The weight of each converter bottom is 12 metric tons, the number of nozzles is 348 with a diameter of 0.57 to 0.59 in. The total blast area when the bottom is new is 2.7 sq. in. per ton of pig iron. With a charge of 35 tons of pig iron and a new lining the blowing time averages 18 min. and the total time between charges is 30 min. The yield from the materials charged is 89 per cent and the average output is thus 60 tons of mild basic steel per hour. Liquid pig iron is charged from the mixer at about 2150 deg. F. and the blast pressure is 2¼ atmospheres.

OBITUARY

ROBERT A. PENDERGRASS, vice-president, McClintic-Marshall Co., New York, died suddenly at his home at Hastings-on-Hudson, N. Y., Dec. 20. He was born at Troy, N. Y., May 11, 1876, and was graduated from Cornell University with the degree of master of civil engineering. Throughout his career he was identified with structural engineering, and all with the McClintic-Marshall organization, save for the summer of 1900, when he started out as draftsman with the American Bridge Co.

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JOHN CORWIN VANCE, president and general manager of the John C. Vance Iron & Steel Co., large iron and steel distributor, Chattanooga, Tenn., died at his home on Lookout Mountain, Dec. 16, at the age of 78. Mr. Vance came to Chattanooga in 1874 as a young man of 19 and became associated with Joe Vance's firm of Vance & Kirby, hardware retailers. The foundation for the John C. Vance Iron & Steel Co. was laid in 1897 when Mr. Vance formed a partnership with James B. Sharp under the name of Sharp & Vance Co. to conduct an iron and steel jobbing business. Besides being head of the John C. Vance Iron & Steel Co., Mr. Vance was president of the Hermitage Portland Cement Co. and was the prime organizer of the Dudley Bar Co. of Birmingham, dealer in reinforcing bars. Mr. Vance was born in Urbana, Ohio, on Dec. 8, 1855. His grandfather was Gov. Joseph Colville Vance, chief executive of Ohio and founder of the city of Urbana.

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JOHN M. LONTZ, since 1904 president of the F. & N. Lawnmower Co., Richmond, Ind., died of heart disease at his home in that city on Dec. 11, aged 71 years.

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DONALD J. MURRAY, pioneer foundry and machine shop owner of Wausau, Wis., died Dec. 13, aged 89 years. He was born in Scotland on March 23, 1844, and emigrated to Wisconsin in 1867. After working in a number of shops in Michigan and Wisconsin, he went to Wausau, Wis., and in 1874 formed a partnership with Ely Wright as Wright & Murray. Mr. Murray took over the business in 1880 and organized the D. J. Murray Mfg. Co., which he developed into a leading manufacturer of heavy machinery in the Central West. Mr. Murray disposed of his interests and retired in 1921.

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GEORGE G. TEBBETTS, engineer of structures for the Chicago Rapid Transit Co., died Dec. 20, after an operation. Mr. Tebbetts was born in Chicago and was graduated from the University of Illinois in 1899.

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WILLIAM J. MYERS, former president of the Union Stove Works, New York, and for years prominent in the National Association of Stove Manufacturers, of which he became president, died Dec. 9, in Brooklyn, N. Y., aged 79 years.

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MILTON D. MCINTYRE, manager of the insurance, safety and welfare department of Pickands, Mather & Co., Cleveland, died suddenly on Dec. 10, of a heart attack, aged 58 years. He had been with the firm 38 years, his first employment being as a mail clerk.

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FRANK LUGAR NORTON, vice-president of the Scullin Steel Co., St. Louis, with headquarters in New York, died suddenly in the latter city of heart disease. He was 64 years old. Mr. Norton had been connected with the Scullin company for the last 30 years, beginning as a salesman.

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BENJAMIN EMERMAN, president of the Erie Scrap Iron Co., Erie, Pa., died at a hospital in that city on Dec. 11 after a short illness. He was 79 years old. He had been identified with the scrap iron business since 1887.

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THOMAS FINIGAN, executive vice-president, American Brake Shoe & Foundry Co., died Dec. 25, at his home in Chicago. He was born at Paterson, N. J., 51 years ago. His boyhood was spent in San Francisco. For a number of years he was in charge of all Western operations of the foundry company and he was an officer or a director of a number of allied companies. Mr. Finigan was a founder member of A Century of Progress Exposition.

The importance of ascertaining the optimum length of exhaust pipe for an internal combustion engine is suggested in a paper read by Kyle C. Whitefield, Wilkinsburg, Pa., before the American Society of Mechanical Engineers. When the exhaust port opens, he points out, a relatively high pressure impulse is started along the exhaust pipe which travels along the exhaust pipe at the velocity of sound. It goes out at the end of the pipe, and in some manner a reflection is propagated back down the pipe and is reflected from the closed exhaust port and so on until it is damped out. If it should return to the exhaust port as the port is opening or open, it will cause detrimental effects on the scavenging of the engine and make for poor operation. In the case of a Diesel engine he found the most favorable lengths of exhaust pipe to be 38 ft., 64 ft. and 86 ft., with a preference for the 38 and/or 86 ft. lengths because the exhaust temperature was higher for the 64 ft. length.

Light-Weight High-Speed Passenger Trains

THE development of light-weight high-speed passenger trains was discussed by E. E. Adams, vice-president, Pullman, Inc., Chicago, before the American Society of Mechanical Engineers in New York on Dec. 5. The following is an abstract of Mr. Adams's paper presented at that time:

Passenger travel on the railroads of the United States has been steadily declining since the peak year of 1920. The executive officers of the Union Pacific several months ago reached the conclusion that to save and restore passenger business to the rails would necessitate the development of a radically different type of passenger equipment. A modern 10-car steam train weighs approximately 1000 tons, including the locomotive, and this limits the speed even with the most modern locomotives, and the costs are comparatively high. An exhaustive study was instituted looking toward the development of a light, high-speed train which would provide safe, comfortable transportation at a minimum of cost.

Such a train has been developed. It will soon be operated on special runs between the larger cities on the Union Pacific system, with the purpose of demonstrating its practicability for regular main-line through-passenger-train service, including transcontinental.

The design has been based largely on automotive and aircraft developments, where speed and light weight, combined with strength, have been vital necessities. To obtain light weight, with strength, the train is being constructed either of aluminum alloys, which have the strength of ordinary steel with one-third the weight, or of stainless steel, which has three times the strength of ordinary steel, and therefore requires but one-third of the material to obtain equivalent strength. In place of the conventional underframe now used on passenger cars, which takes all of the shock and in addition carries the super-structure and the load, each car in this new train is tubular in shape, and the entire car body forms a deep, stiff beam, thereby requiring a minimum amount of material for a given strength.

The equipment is designed for a maximum speed of 110 miles an hour, with a sustained speed on straight and level track of 90 miles per hour. The train of three cars will weigh not over 80 tons, which is the present weight of one Pullman sleeping car.

The train is fully streamlined to a greater extent than has been attempted to date either in this or any foreign country. In order to refine the streamline design, models were

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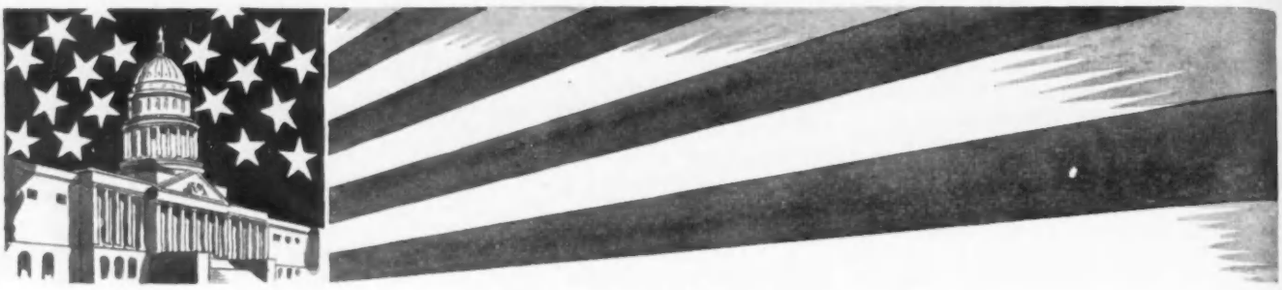


THIS WEEK IN WASHINGTON

Emergency Council to Be Powerful

Full Significance Now Being Realized—Code Hearings Being Speeded Up as Year Ends

By L. W. MOFFETT
Resident Washington Editor, The Iron Age

WASHINGTON, Dec. 26.—No agreement has yet been reached regarding plans to limit Government membership on NRA code authorities to one member. General Johnson thinks the ideal arrangement is to confine Government membership to one with veto but without voting power. At present most codes are limited to one Government member although some have three and some as many as six members. If Government membership is confined to one, it will be necessary to get Presidential approval, and present codes with more than one member would have to be revised. In General Johnson's opinion, this would be a good thing.

Emergency Council Membership

The recently organized and far-reaching National Emergency Council, according to General Johnson, will not be a "grand political grab bag." On the other hand, he stated, there will be several State directors, and the General ventured the opinion that the council is going to have "deserving Democrats," as opposed to Republicans, in those positions. He said, however, that he had been consulted in the selection of the administrators, and that appointees of the council would not necessarily be of a political character through Senatorial action.

The council will replace existing compliance boards and its purpose is said to be to consolidate, coordinate and make more efficient the emergency activities of the entire Federal Government. With a director in each State and a council in each county throughout the United States, the organization will have its headquarters in Washington where Frank C. Walker will be in temporary charge as executive director. Merged into the council will be the numerous emergency organizations and one of the outstanding purposes is to provide machinery, temporary in character, for the adjustment of such controversies as may arise from the operation of the NRA and the AAA. The purpose of the State directors and county councils has been described as that of linking local activities with Federal administrative power.

Organization Set-up

State units will be charged with the task of appointing county and even city officials, the whole to be consolidated into the single organization. There are 3000 counties alone which will have these local councils and above them will be organizations in all the larger towns and cities of the country. The Civil Works Administration, also will come under the council. The 48 State directors will receive from $4000 to $6000 a year.

The tremendous power of the council, which will have a finger in business, finance, agriculture, etc., is just beginning to be realized. Not only will it coordinate the activities of the NRA, AAA, CWA, PWA, and other emergency organizations, but it will mean elimination of all volunteer field agencies. The volunteer field agencies include county directors and committees and city directors and committees and regional directors and committees in charge of about 35 separate recovery activities.

Many have seen in this organization a further great stride toward Government supervision over business, finance and industry, through enormous Government financial contributions, either in the way of loans or outright grants, thus adding tremendously to the number of jobs and the fastening of office holders to the Federal payroll.

Code Wages Not Too Low

General Johnson has described as a "perfectly absurd" criticism of the differences in wages under codes and those paid by the CWA. One administrator has called it an "indictment of the NRA codes," but General Johnson denies that it is an indictment of anything. He explains that Government-distributed money is practically a dole, and that asking industries which have to go on making profits to pay equivalent wages is a different situation.

Hours Not to Be Reduced

The possibility of adjusting the usual number of working hours in codes, "possibly in view of a probable drive in Congress for a compulsory 30 or 35-hr. week," is considered remote by General Johnson. He admits, however that if he finds that there is an economic possibility of so doing it, he would do it.

"I think it will have to be done," says the General, "but we can't wreck industry while we are doing it. Recent hearings have brought this out very clearly."

Labor Get Recognition in NRA

The first representative of organized labor to be so recognized, Major George W. Berry, president of the Pressmen's and Assistants' Union, has been appointed to temporarily relieve General C. C. Williams as Divisional Deputy Administrator of the

NRA. In announcing the appointment of Major Berry, General Johnson said that General Williams, former Chief of Ordnance of the Army, asked to be released because of illness in his family.

Major Berry is a member of the Labor Advisory Board and also of the National Labor Board of the NRA. General Williams will leave the NRA Jan. 1, but General Johnson said he understood that he will return whenever the situation permits.

In his new capacity, Major Berry will be in charge of the codes for the boot and shoe and chemical industries.

Consumers' Board Approves Codes

Organized labor attacked and the NRA Consumers' Advisory Board complimented 40 codes of capital goods industries at a hearing last week before Deputy Administrator H. O. King. Twenty-seven of these codes were presented for the first time and 13 were reopened in order that their sponsors might participate in the general hearing. Despite the number of codes, the hearing was completed in one day, indicating the speeding up of the NRA in its efforts to codify all industries as quickly as possible.

Labor provisions were protested in a voluminous brief submitted by E. C. Davison, representing the American Federation of Labor, by Fred Hewitt, who addressed the hearing on behalf of the NRA Labor Advisory Board, and John P. Frey, secretary of the Metal Trades Department of the American Federation of Labor. Shorter hours and higher rates of pay than those carried in the codes were asked. The codes are virtually identical as to hours, wages and other labor provisions, but differ somewhat in the trade practice and administrative sections.

In contrast to the stand of organized labor, Earl Kekrich complimented the industries on behalf of the Consumers' Advisory Board for having presented "fairly satisfactory codes." He said the proposed cost provisions were "acceptable in the main" since they sought to limit sales prices only by individual costs of production. He questioned, however, the desirability of giving a code authority the power to determine what were production costs. He also asked that the interval for price revisions to become effective be limited to five days in the case of simple industries and 10 days for those of more complex structure.

Codes Presented by MAPI

The codes cover industries affiliated with the Machinery and Allied Products Institute and were presented by John W. O'Leary of Chicago. He asked that reference to the MAPI be deleted wherever it occurred in the codes. Mr. O'Leary pointed out that the question had been raised as to the particular part MAPI had in the formulation of the codes and that the institute desired that all reference to it be stricken out to avoid any possible confusion. It was explained by Mr. O'Leary that the institute was formed for the purpose of advising member industries on code matters, the principal purpose being to establish uniform employment conditions in kindred industries. He added that each trade association in the MAPI had retained full autonomy in dealing with the NRA.

The codes presented for the first time covered the following industries: Bakery equipment, sprocket chain, locomotive, railroad and industrial spring, steel tie, wire machinery, hair clipper, oil field pumping engine, jack, envelope machinery, mechanical lubrication, rolling mill machinery, chemical engineering equipment, power transmission equipment, contractors' pump, caster and floor truck, diamond core drill, roller and silent chain, water softener, reduction machinery, concrete mixer, air filter, refrigerating machinery, hydraulic machinery, waterpower equipment, railroad appliance and small locomotive.

Codes reopened covered the following industries: Beater, jordan and allied equipment, cereal machinery, conveyor and material preparation equipment, Diesel engine, hoist, hoisting engine, kiln, coiler and dryer, pulverizing machinery and equipment, rock and ore crusher, sawmill machinery, steam engine, water meter and woodworking machinery.

Tentative dates of Jan. 4, 8, 11 and 15 were announced by Deputy King for post-hearing conferences between representatives of the NRA and the code committees of the various industries to consider further wages, hours and administrative proposals advanced at the hearing.

Other Group Hearings

Supplemental codes for four subdivisions of the fabricated metal products manufacturing and metal finishing and metal coating industry were heard last week by Deputy Administrator L. S. Horner. Three of the codes, chain manufacturing, hand chain hoist, and electrical industrial truck, are virtually identical in text and were presented by C. M. Dinkins, counsel for the Fabricated Metal Products Federation. The fourth, tool and implement manufacturing, also was presented by Mr. Dinkins but differs in administrative and trade practice provisions. All four codes were greatly revised and amended in the course of their presentation.

Continuing its consideration of codes supplementary to the basic code of fair competition for the fabricated metal products group the NRA conducted public hearings on proposals submitted by the steel package manufacturing, galvanized ware manufacturing, washing machine parts manufacturing, milk and ice cream can and standard barrel and drum manufacturing industries. D. S. Hunter, chairman of the allied code committees of the five sponsoring organizations, presented the documents.

No Objections to Chilled Car Wheel Code

Complete absence of objectors characterized the hearing on the chilled car wheel industry's proposed code, which was presented by E. P. Waud, representing the Association of Manufacturers of Chilled Car Wheels, claiming to speak for 86 per cent of the industry. In a supporting statement, Mr. Waud declared that approximately 90 per cent of rail-borne commerce was moved on wheels produced by the firms for which he spoke.

Die Casting Code Heard

Brief objections to the sections on definitions by representatives of the MAPI and the usual complaints from organized labor featured the hearing on the code presented by the die casting industry. The hearing was later recessed subject to the call of the administrator.

Code Hearings Scheduled

A hearing on codes for three related manufacturing industries will be held at 10 a. m. on Thursday, Dec. 28, in the Mayflower Hotel before Deputy Administrator Barton W. Murray. The codes are sponsored by the Industrial Unit Heater Association, the National Association of Fan Manufacturers and the Concealed Heater Manufacturers Association. The three codes are substantially uniform as to hours, an average 40-hr. work-week being provided with an 8-hr. day. In peak seasons the week can be extended to 48 hr.

Hearing on the code of fair competition of the railroad special track equipment manufacturing industry will be held at 10 a. m., Friday, Dec. 29, in the Burlington Hotel, with Deputy Administrator H. O. King presiding. The code proposes an average maximum work-week of 40 hr. in any six-months' period, with a six-day working week and not more than 48 hr. in any one week. For purposes of wage computation the country is divided into five groups with minimum hourly pay ranging from 30c. in the South to 40c. in the Midwest and Colorado areas.

Amendments and a supplement proposed for the approved code of the boiler manufacturing industry will be heard by Division Administrator Malcolm Muir at the Willard Hotel at 3 p. m., Wednesday, Dec. 27. The proposed amendments deal with labor provisions of the code, and would permit firemen, engineers and electricians engaged in maintenance work, as well as stock and shipping clerks and delivery employees, to work in excess of 8 hr. a day, provided that they were not employed more than 44 hr. a week. The supplement proposed covers changes in administration and trade practices.

Die Casting Industry Code Hearing Brings Out Much Protest From Labor

WASHINGTON, Dec. 26.—Sponsors for the code of fair competition for the die casting manufacturing industry presented their code to Assistant Deputy Administrator H. M. Halsted at a hearing held last week. Speaking for the American Die Casting Institute, George A. Fernley formally submitted the code, pointing out that the group for whom he spoke represented 85 to 90 per cent of the commercial die casting manufacturing in this country. He declared that in spite of the fact that the die casting industry has been losing money since 1929 and that the sales volume for the year 1933 was estimated at about 15 per cent of the 1928 level, the compensation of employees has increased during these years. He cited numerous cases where plants had ceased manufacturing die castings in the last few years because of "excess capacity, sales shrinkage and unsound competition," and expressed the opinion that, while the industry was willing to cooperate with the NRA, it was not in a position to continue in business if undue hardships were imposed upon them by the code.

R. L. Bradshaw, of the Machine and Allied Products Institute, objected briefly to the section on definitions. He stated that this section should be so worded as to apply specifically to the manufacturing of commercial die castings. He described 3(e) of Article VII as "unsound and uneconomic" in objecting to its inclusion in the code.

Labor Objects to Entire Code

Edward Unger and Maurice Sundquist, both of New York, representing the National Die Casting Workers League, denounced the proposed code, stating that it "does not comply with the requirements of the National Industrial Recovery Act." They declared that during the last few years the workers have been subjected to numerous abuses and forced to increase their "production at lower wages." They expressed the belief that the code as proposed would do little toward effecting a cure for these problems. They proposed a list of minimum wages for various types of workers in the industry ranging from $60 per week for die casting die makers down to a minimum of $25 per week for shippers and packers. Apprentices, they said, should not be required to serve a 52-week apprentice period and they urged a weekly wage of $13.50 for such class of workers, with $1.50 increase per week after every three month period of apprenticeship. They asked for labor representation on the code authority, and a minimum work-week of 30 hrs., clerical and emergency employees to be permitted to work not more than 35 hrs. a week, all employees to receive time and one-half for overtime.

Mr. Fernley explained, how, although increased costs to the industry of 60 per cent had resulted since the advent of the PRA, a greater volume of business had been done since that date. In response to further questioning, he stated that he did not consider the 52-week period for apprentices to be excessive.

Frank G. Hoover, vice-president of the Hoover Company, North Canton, Ohio, proposed a clarifying amendment to section 8 of Article IX and objected to a provision in Article VII calling for the collection of reports and statistical data from the industry by the code authority. Mr. Hoover declared that such data should be compiled by an impartial agency and held strictly confidential except as a composite report.

Identifying himself as a newcomer in the industry, Alfred Schneier of the Advance Pressure Castings Company, Brooklyn, N. Y., supported the statement of the previous witness. Mr. Schneier referred particularly to the section dealing with the registration of productive machinery in 3 (e) of Article VII and declared that such a provision is discriminatory against the small manufacturer. "We cannot find our place in the sun with any limitation like this," he stated, "and such a clause serves no useful purpose in the program of recovery."

More Railroad Loans Approved—Large Rail and Accessory Tonnage Involved

WASHINGTON, Dec. 26.—Approval of applications of the Chicago & North Western and the Chicago & Eastern Illinois railroads to borrow money from the PWA to purchase rails and track fastenings has been formally announced by the Interstate Commerce Commission.

The North Western will purchase 65,000 gross tons of rails and 18,000 gross tons of accessories and fastenings, the rails to cost $36.375 a ton, plus transportation charges, for a total cost of $2,403,375. The fastenings and accessories, including tie plates, will cost about $1,058,538. It is planned to lay the rails on the heavy-traffic, high-speed main lines, particularly at different places between Chicago and Council Bluffs, Iowa. Rails also are to be used between Chicago and Elroy, Wis., and between Chicago and Milwaukee.

The Chicago & Eastern Illinois will purchase 1000 tons of 110-lb. rails and 3000 tons of 112-lb. rails, to cost about $155,388 and the necessary fastenings, frogs, switches and other track material to cost $95,912.

President Rules CWA Wages Not Too High

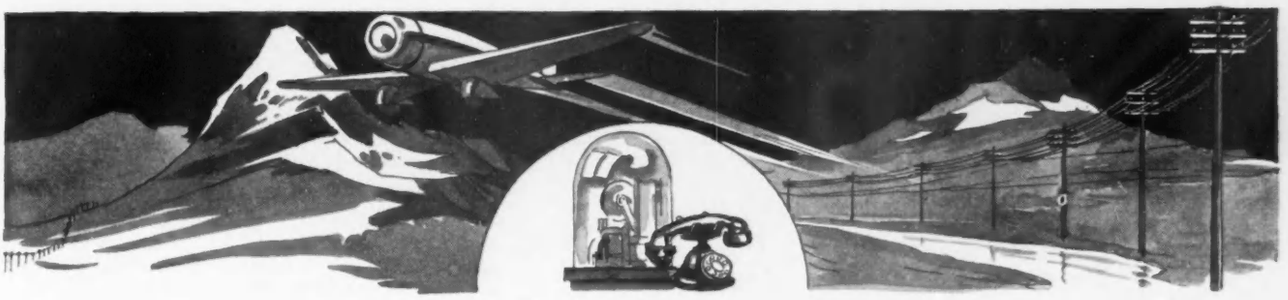
WASHINGTON, Dec. 26. — The difference between General Johnson and Emergency Relief Administrator Hopkins over CWA wages has been settled through White House intervention, with President Roosevelt siding with Mr. Hopkins. The protest of General Johnson that CWA wages were higher than minimum wages fixed in industrial codes has been followed by a White House announcement that no changes would be made in CWA wages unless they were clearly shown to be out of line with the wages paid in the localities affected.

Many complaints from industrialists and other sources have been made against the so-called high wages paid by CWA, ranging from 40c an hour for common labor in the south, 45c in the central zone and 50c in the north. Many NRA codes provide basic minimum wages of 35c. and 40c an hour, with geographical differentials even lower in the south.

Institute Index Declines

The scheduled national rate of operations for steel companies in the last week of December was reported as 31.6 per cent, as compared with 34.2 per cent in the previous week, in the American Iron and Steel Institute's weekly release.

Another contribution to basic information on the properties of iron has been made by the Bureau of Standards in research paper RP606 by H. C. Vacher. It covers experiments to confirm previous indications that the product of the carbon and oxygen contents of liquid iron is 0.0025. This was determined by passing a known mixture of carbon oxides at one atmosphere pressure over liquid iron maintained at 1580 deg. C.



THE NEWS OF THIS WEEK

British Steel Makers Facing Brighter Outlook for 1934

LONDON, ENGLAND, Dec. 26 *(By Cable)*.—A shortage of fuel is hampering British blast furnaces in efforts to increase operations. The holiday quietness is less marked this year and is not likely to be prolonged.

Makers of semi-finished steel are well booked, but heavy steel is still slow.

The prospects for the new year are much brighter, with shipbuilding orders being placed and railway programs involving large steel tonnages becoming evident.

Tin plate business is slow, despite recent large Canadian orders, and is likely to remain so until after the first of the year. Output is at 60 per cent but is likely to go lower as several large independent mills are not reopening.

Richard Thomas has bought the W. G. Gilbertson works, which include 16 tin plate mills and 16 sheet mills.

The Continental steel market is quiet. International rail makers and the international rod cartels are maintaining prices and quotas for the first quarter of 1934. Negotiations are ensuing between British and Continental ship plate makers with the view of forming an Anglo-Continental entente. The purpose of this is to fix minimum prices and export quotas.

British Prices, f.o.b. United Kingdom Ports

Per Gross Ton

Ferromanganese, export	£9		
Billets, open-hrth.	£5 10s.	to	£5 12s. 6d.
Black sheets, Japanese specifications	£11		
Tin plate, per base box	16s. 3d.	to	16s. 9d.
Steel bars, open-hearth	£7 17½s.	to	£8 7½s.
Beams, open-hrth.	£7 7½s.	to	£7 17½s.
Channels, open-hearth	£7 12½s.	to	£8 2½s.
Angles, open-hearth	£7 7½s.	to	£7 17½s.
Black sheets, No. 24 gage	£9 5s.		
Galvanized sheets, No. 24 gage	£11 5s.	to	£11 15s.

Continental Prices, f.o.b. Continental Ports

Per Metric Ton, Gold £

Current dollar equivalent is ascertained by multiplying gold pound price by 124.14 to obtain franc equivalent and then converting at present rate of dollar-franc exchange.

*Ingots	£2 5s.
*Billets, Thomas	£2 7s.
Wire rods, No. 5 B.W.G.	£4 10s.
Black sheets, No. 31 gage, Japanese	£11 5s.
*Steel bars, merchant	£3 2s. 6d.
*Sheet bars	£2 8s.
Plates, ¼ in. and up	£4 1s. 6d.
*Plates, ⅜ in. and 5 mm.	£4 3s. 6d.
*Sheets, ⅛ in.	£4 8s. 6d.
*Ship plates	£4 10s.
*Beams, Thomas	£2 19s.
*Angles (basis)	£3 2s. 6d.
Hoops and strip steel over 6-in. base	£3 17s. 6d.
Wire, plain, No. 8	£5 7s. 6d.
Wire nails	£5 15s.
Wire, barbed, 4-pt. No. 10 B.W.G.	£8 15s.

*Prices as established by European Raw Steel Cartel.

Sales of Sheet Steel Higher in November

SALES of sheet steel products scored a moderate gain in November, while production and shipments fell considerably below the October tonnage, according to the report of the National Association of Flat Rolled Steel Manufacturers, Pittsburgh. According to this report, which is based on figures covering a monthly capacity of 325,000 net tons, or approximately 59 per cent of the country's total capacity of 550,000 net tons, independent producers reported sales of 88,354 net tons in November, compared with 79,141 tons in October; production of 102,585 tons, against 146,106 tons, and shipments of 99,499 tons, compared with 174,829 tons. Unfilled tonnage as of Dec. 1 shrank to 94,270 tons from 102,262 tons on Nov. 1. The Dec. 1 unfilled tonnage represented 29.1 per cent of capacity; the preceding month's figure was 31.5 per cent of capacity. The November report with comparisons of the two preceding months, in net tons, follows:

	Nov.	Oct.	Sept.
Sales	88,354	79,141	145,320
Production	102,585	146,106	180,304
Shipments	99,499	174,829	163,634
Unfilled orders	94,270	102,262	194,223
Unshipped orders	50,455	52,978	61,566
Unsold stocks	55,495	52,353	53,617
Capacity per month	550,000	550,000	550,000
Percentage reporting	59.0	59.0	59.0
Percentages, Based on Capacity			
Sales	27.2	24.4	44.8
Production	31.6	45.0	55.5
Shipments	30.7	53.9	50.4
Unfilled orders	29.1	31.5	59.8
Unshipped orders	15.5	16.3	19.0
Unsold stocks	17.1	16.1	16.5

British Company To Expand Capacity

THE British Iron & Steel Co., Ltd., London, has plans for expansion and improvements at works at East Moors, Cardiff, South Wales, including new furnace units, bar and billet mills, and other structures, to be equipped for annual output of about 300,000 tons. The company will also develop iron ore properties at Llanharan, Glamorgan district, and Oxfordshire. The project will be carried out over a period of two years and will cost about £2,000,000. The company controls joint output of Guest, Keen & Co., Ltd., and Baldwins, Ltd., with plants in district noted.

November Foundry Equipment Index Off

THE Foundry Equipment Manufacturers Association has announced that the index of net orders for equipment in November was 36.62 for 21 reporting companies, against 42.46 in October for 19 reporting companies, and 11.5 for November, 1932, as reported by 14 leading manufacturers. The index of November shipments was 38.31 and the unfilled order index as of Nov. 30 was 29.63, compared with 42.07 and 31.7, respectively, in October.

▲▲▲ PERSONALS ▲▲▲

J. B. DOAN, president of the American Tool Works Co., of Cincinnati, has been elected to the Board of Directors of the First National Bank of Cincinnati. This is the second important directorate conferred upon Mr. Doan within the past month, the first having been to the board of the American Rolling Mill Co., Middletown. Mr. Doan has been associated with the machine tool industry of Cincinnati since early manhood, beginning his service as office boy with Lodge, Davis & Co., predecessors of the American Tool Works Co.

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L. E. IVES, for the last 13 years sales manager and shipping agent at Cleveland for Clement K. Quinn & Co., formerly large miners and shippers of Lake Superior iron ores, has recently opened his own ore and lake transportation office at 1311 Guarantee Title Building, Cleveland. He will act as sales and shipping representative for the North Range Mining Co., Negaunee, Mich., which recently took over the Blueberry mine on the Marquette Range in Michigan from the Ford Motor Co., and is now operating that property. He also represents the Tennessee Copper Co., Copperhill, Tenn., in the sale of "Copperhill sinter," for blast furnace use. He will also handle the sale and shipments of iron ore stockpiles at the Archibald Mine on the Marquette Range.

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JOE MCNALLY, formerly connected with the Railway Car & Equipment Co., Chicago Steel Car Co., and the General American Tank Car Corpn., has become associated with Iron & Steel Products, Inc., Railway Exchange Building, Chicago, dealer in railway supplies.

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CLEVE W. RITZ has been appointed manager of sales in the Ohio district, with offices at 1210 East Fifty-fifth Street, Cleveland, for the Columbia Steel & Shafting Co.

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PERCY LISTER, managing director, R. A. Lister, Ltd., Dursley, England, largest producer of small Diesel engines in Europe, has been spending some time in the United States, in conference with HARRY L. HORNING, president, Waukesha Motor Co., Waukesha, Wis., with reference to license and royalty manufacturing interchange and general Diesel development.

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JOHN M. LLOYD, who was associate mechanical editor of THE IRON AGE from 1911 to 1918 and for more than 14 years head of the publication department of the Society of Automotive Engineers, has become associated with Kellogg & Tree, New York, as manager of their trade and consumer publicity department. Kellogg & Tree are engaged in industrial sales promotion work, both domestic and foreign.

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JOHN C. TAYLOR, JR., vice-president of the Taylor-Wharton Iron & Steel Co., has been elected a member of the board.

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DR. R. W. MITCHELL, technical director of the Dif Corpn. and Magnus Chemical Co., Garwood, N. J., sailed on Dec. 16 for a six weeks' business trip through England, France and Italy.

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HOWARD COONLEY, president of the Walworth Co., New York, has been reelected president of the American Standards Association. F. E. MOSKOVICS, chairman of the board of the Marmon-Herrington Co., Indianapolis, has been reelected as vice-president. J. C. IRWIN, representing the American Railway Association, and F. M. FARMER, representing the American Society for Testing Materials, have been elected to the chairmanship and vice-chairmanship, respectively, of the Standards Council of the ASA.

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MAJ. R. A. BULL, consultant on steel casting practice, Chicago, and for 13 years director of the Electric Steel Founders' Research Group, has been retained to devote part of his time as consultant and mid-west representative, with office at 541 Diversey Parkway, Chicago, by the Ajax Electrothermic Corpn., Trenton, N. J. Major Bull is a past-president of the American Foundrymen's Association and received the Seaman gold medal for his contributions to foundry practice.

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L. W. BRIGGS, who has been associated with the West Leechburg Steel Co. since 1919, and for the past nine years as sales manager in the Chicago district, has been appointed general sales manager, with headquarters at Pittsburgh.

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GEORGE DISQUE has resigned as a sales representative at Detroit of the Crucible Steel Co. of America and the Halcomb Steel Co. He first became connected with the latter company in 1909 at its plant at Syracuse, N. Y., and since 1918 has been located at Detroit. When the Crucible company took over the Halcomb company two years ago, Mr. Disque continued at Detroit with the merged organization.

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FRANK D. CHASE, prominent Chicago consulting engineer, has been appointed executive director of the Civil Works Administration in Illinois.

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WALTER HARNISCHFEGER, president, Harnischfeger Corpn., Milwaukee, has returned from Europe, where he spent a month in business investigation in Belgium, France, Germany and Russia.

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T. M. GLOECKNER, who has been associated with the sales organization of the Union Drawn Steel Co., Massillon, Ohio, for more than 15 years, has been appointed district sales manager for the Philadelphia territory, effective Jan. 1. He will make his headquarters at 2030 Fidelity-Philadelphia Trust Building.

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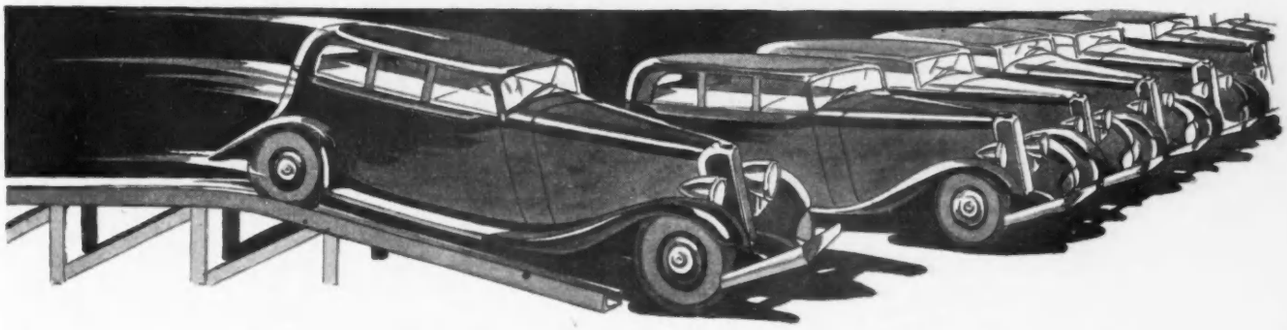
G. FURMAN MATHER, who has been associated with Frank Samuel & Co., Philadelphia, on Jan. 1 will join the Philadelphia organization of the Charles Dreifus Co.

November River Shipments Lower

MOVEMENT of iron and steel products on the Ohio River in the Pittsburgh district in November amounted to 39,573 net tons, contrasted with 49,047 tons in October, 38,480 tons in September, and 45,735 tons in November, 1932, according to the latest report of the United States Engineer Office at Pittsburgh. Shipments of steel products on the Monongahela River in November aggregated 28,216 tons, compared with 39,026 tons in October, and 29,851 tons in November, 1932. Shipments of iron and steel on the Allegheny River in November totaled only 1550 tons.

Creep Tests at 1600 Deg.

CREEP characteristics at 1600 deg. F. of 15 different alloys, covering a range of chemical composition from 1 to 75 per cent nickel and from 3 to 55 per cent chromium, were determined at the Bureau of Standards by W. A. Tucker and S. E. Sinclair, who have reported the findings in research paper No. 572, obtainable from the Superintendent of Documents, Washington, at 5c. a copy. The determinations supplement a previous investigation at 1000 deg. At 1600 deg. the strongest alloys are those containing approximately equal parts of nickel and chromium and not more than 30 to 40 per cent iron.



▲▲▲ THIS WEEK ON THE ASSEMBLY LINE ▲▲▲

Ford Increases Production as General Motors and Chrysler Are Delayed

DETROIT, Dec. 26.

WITH General Motors and Chrysler harassed by serious production delays and in some cases building models by hand for display at the New York automobile show, Ford is in the best strategic position in several years. Because there were no important changes in design of the new V-eight car, Ford was not affected by the recent strike of tool and die makers. Assemblies therefore have gone ahead according to schedule and today Ford finds itself in the enviable position of being the only low-price manufacturer with cars to sell.

The Ford sales organization has not been slow to take full advantage of the situation and today is pushing the factory for deliveries. Starting the month with a tentative schedule of 25,000 units, Ford has had to revise production upward several times and probably will turn out 42,000 cars in December. Operations at the Rouge plant reached 2000 units a day the past week, and every effort is being made to boost the rate as soon as possible to 3000 a day.

Early in 1933, when Mr. Ford was counting on having two cars in his line, a large V-eight and a very small job, the tooling up at Dearborn is said to have been for one-third of the plant to be devoted to manufacture of the present car and two-thirds to model 44. This means that Ford will have to push production to the utmost to get 3000 of the current V-eights without resorting to purchase of further equipment.

Despite the fact that the small job has been dormant for months, it is by no means out of the 1934 automotive picture. Much machinery and a considerable number of dies have been made for it, and many automobile parts manufacturers are ready to start work on it on short notice. Signs are multiplying to indicate that model 44 may appear in the spring, especially if the automobile market opens up to the extent that some of Detroit's sales executives predict.

Ford's Show Is Huge Success

Ford's New York show has exceeded the company's most optimistic hopes, attendance on some days having run higher than the average daily attendance at A Century of Progress. Ford's plans for the first two months of the new year are said to remain unchanged, with 50,000 units projected for January and 75,000 for February.

While Ford continues to make production gains, Chevrolet and Pontiac are being held back by long delays in securing certain dies and in the slowness in stepping up manufacture of the new front-end units. In both these cars coil springs will be enclosed in a welded steel housing. The production bottle neck just now is in the welding of this steel housing. The entire unit for both cars is built at Chevrolet's Detroit plant.

First Pontiac Rolls Off Line

Chevrolet will assemble a few passenger cars this month, but it will be Jan. 1 before volume production is attained. Pontiac's first 1934 car rolled off the line last Wednesday, and an attempt will be made to assemble 3000 cars the remainder of this month with the factory working 24 hrs. a day. Pontiac's January schedule is 12,000 units. H. J. Klingler, president and general manager of the Pontiac company, has confirmed the statement published in this column on Nov. 2 that Pontiac's goal in 1934 is the production and sale of 150,000 units, as against about 85,000 units this year.

The new Pontiac carries last year's streamlining one step further, another inch of backward tilt having been added to the chrome grilled radiator and front fenders being more deeply crowned and brought lower in front. The car has a 117¼ in. wheelbase, or 2 in. longer than in 1933, the hood is 7 in. longer, and the interior of the body roomier. The four-door sedan weighs 3480 lb. Piston displacement remains at 223.4 cu. in, but compression has been raised to a ratio of 6.2 to 1. Pontiac still employs a crossflow radiator. "Fountain cooling" of valves is achieved by water pumped directly from the radiator through a tube extending the length of the motor block. Metered holes in the tube direct streams of cooled water against the water jackets surrounding the valves, this arrangement eliminating the necessity for special heat resisting valve inserts.

Coil Springs Are In Steel Housing

The coil spring and hydraulic shock absorber for either front wheel are operated in a steel housing in an oil bath which lubricates all internal working parts. Brake drums are of high carbon manganese alloy steel with corrugated exterior rims which double the air cooling surface. The frame is of the "K-Y" box girder type, weighing 270 lb. An improvement of 10 per cent in fuel economy is claimed for the straight eight engine. The Pontiac probably will not be announced until show time.

Oldsmobile still is experiencing difficulty getting started. It is making elaborate preparations for sales campaigns on its small six and large eight to dispose of a total of 100,000 cars in 1934. Cadillac is slowly swinging into production. It will offer a La Salle straight eight, Cadillac V-eight, Cadillac V-twelve and Cadillac V-sixteen.

De Soto Has Striking Appearance

The sensation of the week is expected to be the public debut today of the Airflow De Soto six. It represents the greatest single departure from conventional design that the automobile industry has seen in more than a decade. The body and frame are a single all-steel unit, with the body trussed with steel girders like a bridge, as sturdy at the front as at the rear. Passengers ride inside the frame instead of over it, with the body forming a protecting wall of steel. This type of frame construction, a revolutionary innovation in the automobile industry is claimed to be 40 times more rigid than the conventional type.

Gracefully rounded to "bore" through air currents, the front of the car has a striking appearance. The radiator, wider and shorter than in other cars, is concealed beneath a chromium grille. Headlamps are sunk into the body, fenders form an integral part of the streamlined shape. At the rear the body curves downward in true streamline form. This design reduces wind resistance 40 per cent, compared with that of 1933 cars.

It is asserted that because of the new type of design, with the motor over the front axle and both front and rear seats located between the axles, coil springs are not necessary on the De Soto or the Chrysler, which will resemble the De Soto. Chrysler Corpn. will confine coil springs to the Plymouth and Dodge lines.

On account of the new steel girder frame construction on De Soto and Chrysler, it has been necessary for Chrysler Corpn. to change entirely its method of car assemblies at its Jefferson Avenue plant in Detroit.

The Plymouth and Dodge divisions of Chrysler are now reported to be in the initial stages of volume production. However, the only De Soto models yet manufactured have been hand-built cars, and both De Soto and Chrysler will have to go to the New York show with hand-made cars, according to reliable reports.

December Output About 70,000 Units

At this time it is virtually impossible to tell what the December total for the industry will be, because of the shroud of secrecy thrown around operations of many plants. However, assemblies up to Dec. 23 had been less than 50,000 units, and even with the expansion looked for this week, December will do well to cross the 70,000 mark.

January schedules of the industry continue to promise an output of more than 200,000 units. Whether this mark will be attained depends on how quickly important makers, like Chevrolet and Plymouth, can get production up to a satisfactory volume.

Steel Buying Increases

Steel buying the past week has shown an encouraging upward trend. Ford, Chevrolet, Pontiac and Oldsmobile were among the active purchasers. Ford of Canada has been ordering steel at the highest rate in months. Further steel releases from the Ford Motor Co. for its Rouge plant are anticipated in the next 10 days.

Citroen and Buick Machine Tool Orders Total $3,500,000

Machine tool orders placed in this country by Andre Citroen, French automobile manufacturer, have totaled more than $2,000,000. The Buick Motor Co. has awarded further equipment contracts for its small car, the production of which will begin in March. American machine tool builders have received about $3,500,000 worth of business from Citroen and Buick in the last two weeks.

New car prices for 1934 are up from $5 to $50. At the same time used car allowances are down about $50 on a low-price car because of strict trade-in provisions in the dealers' code. This means that the new car buyer will lose at both ends. Factory executives are genuinely concerned over the matter of keeping this spread down to the barest minimum, otherwise they feel that a good retail market may be spoiled.

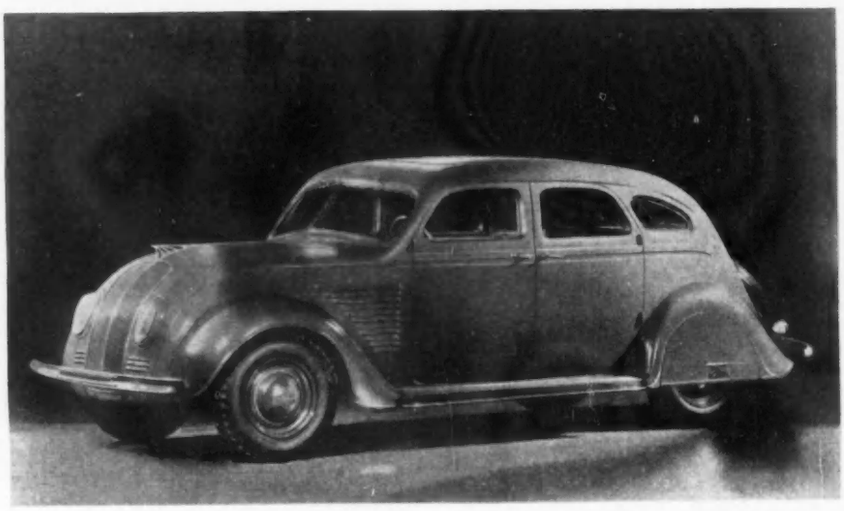
Ford's production in January will be the largest for that month since 1930 and will exceed the total for every month of 1933 except June, July and August. Production last Thursday, at 2080 units, was the largest since Sept. 25. There has been a noticeable growth in Ford's truck sales since the recent reduction in prices.

Willys-Overland to Make 5000 Cars

The federal court at Toledo has granted the Willys-Overland Co. permission to make 5000 more of its model 77 cars despite the strong protest of the bondholders committee. Charles Wilson, president Wilson Foundry & Machine Co., Pontiac, Mich., subsidiary of Willys-Overland, has been appointed co-receiver of the company with John Willys, succeeding L. A. Miller, former president. Proof was submitted to the court that the company can make a small profit on further operations which will employ about 3000 men through January and February.

Studebaker Advances Prices

Studebaker Corpn. has increased list prices on passenger cars $20 to $50. Shipments of passenger cars and trucks in the fourth quarter will total 19,000 units.



THE much-heralded Airflow De Soto, the first truly streamlined car, will make its debut at the New York show on Jan. 6. Its rounded nose and tapering rear are an application of aerodynamic theories of aviation and automotive engineers. The motor is located over the front axle, the rear seat is ahead of the rear axle, so that passengers ride between the axles.

December Steel Shipments Will Exceed Those of November or October

Production in Final Week of Year Will Average 34 or 35 Per Cent—Strong Scrap Market Foreshadows Good First Quarter

AFTER an interruption on Christmas, steel output has rebounded to 37 per cent of capacity, as compared with 36 per cent a week ago. However, operations are likely to taper off as the year-end approaches and the time required for conversion into finished material precludes further production of raw steel against fourth quarter contracts.

The average ingot rate for the week may drop to 35 or 34 per cent, but there will not be a corresponding decline in rolling mill operations, which will be pushed until the closing day of the year to get out shipments. While the tension under which the industry is working is fully as severe as a week ago, it now seems probable that virtually all the tonnage specified against contracts will be rolled and on cars before the deadline date.

WHATEVER the production statistics of the month may show, it is reasonably certain that aggregate steel sheet shipments will run ahead of those of November or October, besides exceeding the movement in any previous December in recent years.

While much of this tonnage has been driven in by price advances and therefore represents an expansion of stocks rather than of consumption, it is notable that little of it has been placed by the automobile industry, which was the most conspicuous sustaining factor in demand during the earlier months of the year. Nor can much of the tonnage be attributed to public works projects, exempt from quarterly contract regulations under the identified structure provision, or to railroad buying, which is still mainly in the formative stage.

It is largely because of the excellent prospects for tonnage from the big three — automobiles, public works and railroads—that the steel industry regards the first quarter outlook as so favorable. Certain mills, such as tin plate plants, may enter January with scant backlogs and sharply reduced operations. Others, notably wire mills, will be able to maintain a fairly good rate of production for a time replenishing exhausted stocks. But regardless of whether steel output slumps in the early part of January, the industry is confident that there will be a strong rebound later.

MARKET sentiment is reflected in the uninterrupted rise of scrap prices, which are always a sensitive barometer. Advancing for the fifth consecutive week, THE IRON AGE composite for heavy melting steel has risen to $11.08 a ton, compared with $10.67 a ton last week and $9.83 a ton at the beginning of the current upward movement. Railroads and other producers of scrap, as well as dealers, are holding back their accumulations for higher prices. Meanwhile consumers have been scouring the market in an effort to build up stocks, a Central Western steel company having purchased close to 80,000 tons in the past 30 days.

The scheduled blowing in of a southern Ohio steel company blast furnace Jan. 1 is also an indication of confidence in the first quarter outlook.

IN the automobile industry Ford has benefited because of the delay of other motor car builders in getting out their new models. Starting December with a tentative schedule of 25,000 cars, Ford has been forced to revise production upward and will probably turn out 42,000 units. Slow deliveries of dies from shops outside of Michigan have held back the operations of other automobile makers and total output of the industry this month may not exceed 70,000. January output, however, promises to run well over 200,000 units.

The machine tool industry has obtained orders for $3,500,000 worth of business from the Buick and Citroen companies within the past fortnight. The orders placed by the French company, estimated at more than $2,000,000, are reported to have been divided among the National Automatic Tool Co., the Ingersoll Milling Machine Co., the Landis Machine Co., the LeBlond Machine Tool Co., the Cincinnati Milling Machine Co., the Kearney & Trecker Co., and the Sundstrand Co.

IN agricultural areas heavier distribution of wire products has resulted from the improved financial position of farmers. The same influence is seen in slightly heavier steel specifications from agricultural equipment manufacturers.

Fresh rail orders include 5000 tons placed by the Delaware & Hudson, 12,000 bought by the Delaware, Lackawanna & Western and 500 tons purchased by the Richmond, Fredericksburg & Potomac. The Central of Georgia will buy 3000 tons of rails. The Erie is in the market for 133 passenger cars, while the Northern Pacific has ordered 10 locomotives.

STEEL operations have risen six points to 31 per cent in eastern Pennsylvania, two points to 43 per cent at Buffalo, five points to 50 per cent in the Wheeling district and seven points to 52 per cent at Detroit. At Cleveland they have declined five points to 47 per cent.

THE IRON AGE composite prices for finished steel and pig iron are unchanged at 2.028c. a lb. and $16.90 a ton respectively.

▲▲▲ A Comparison of Prices ▲▲▲

Market Prices at Date, and One Week, One Month, and One Year Previous
Advances Over Past Week in Heavy Type, Declines in Italics

Pig Iron

	Dec. 26, 1933	Dec. 19, 1933	Nov. 28, 1933	Dec.27, 1932
Per Gross Ton:				
No. 2 fdy., Philadelphia	$19.26	$19.26	$18.26	$13.34
No. 2, Valley furnace	17.50	17.50	17.50	14.50
No. 2 Southern, Cin'ti	18.13	18.13	18.13	13.82
No. 2, Birmingham	13.50	13.50	13.50	11.00
No. 2 foundry, Chicago*	17.50	17.50	17.50	15.50
Basic, del'd eastern Pa.	18.76	18.76	17.76	13.50
Basic, Valley furnace	17.00	17.00	17.00	13.50
Valley Bessemer, del'd P'gh	19.76	19.76	19.76	16.89
Malleable, Chicago*	17.50	17.50	17.50	15.50
Malleable, Valley	17.50	17.50	17.50	14.50
L. S. charcoal, Chicago	23.54	23.54	23.54	23.17
Ferromanganese, seab'd carlots	82.00	82.00	82.00	68.00

*The switching charge for delivery to foundries in the Chicago district is 60c. per ton.

Rails, Billets, etc.

Per Gross Ton:				
Rails, heavy, at mill	$36.37½	$36.37½	$36.37½	$40.00
Light rails, Pittsburgh	32.00	32.00	32.00	30.00
Rerolling billets, Pittsburgh	26.00	26.00	26.00	26.00
Sheet bars, Pittsburgh	26.00	26.00	26.00	26.00
Slabs, Pittsburgh	26.00	26.00	26.00	26.00
Forging billets, Pittsburgh	31.00	31.00	31.00	31.00
Wire rods, Pittsburgh	36.00	36.00	35.00	37.00
	Cents	Cents	Cents	Cents
Skelp, grvd. steel, P'gh, lb.	1.60	1.60	1.60	1.60

Finished Steel

Per Lb.:	Cents	Cents	Cents	Cents
Bars, Pittsburgh	1.75	1.75	1.75	1.60
Bars, Chicago	1.80	1.80	1.80	1.70
Bars, Cleveland	1.80	1.80	1.80	1.65
Bars, New York	2.08	2.08	2.08	1.95
Plates, Pittsburgh	1.70	1.70	1.70	1.60
Plates, Chicago	1.75	1.75	1.75	1.70
Plates, New York	1.98	1.98	1.98	1.898
Structural shapes, Pittsburgh	1.70	1.70	1.70	1.60
Structural shapes, Chicago	1.75	1.75	1.75	1.70
Structural shapes, New York	1.95¼	1.95¼	1.95¼	1.86775
Cold-finished bars, Pittsburgh	2.10	2.10	1.95	1.70
Hot-rolled strips, Pittsburgh	1.75	1.75	1.75	1.45
Cold-rolled strips, Pittsburgh	2.40	2.40	2.40	2.00

Finished Steel

	Dec. 26, 1933	Dec. 19, 1933	Nov. 28, 1933	Dec.27, 1932
Per Lb.:	Cents	Cents	Cents	Cents
Hot-rolled annealed sheets, No. 24, Pittsburgh	2.25	2.25	2.25	2.10
Hot-rolled annealed sheets, No. 24, Chicago dist. mill	2.35	2.35	2.35	2.20
Sheets, galv., No. 24, P'gh	2.85	2.85	2.85	2.85
Sheets, galv., No. 24, Chicago dist. mill	2.95	2.95	2.95	2.95
Hot-rolled sheets, No. 10, P'gh	1.75	1.75	1.75	1.55
Hot-rolled sheets, No. 10, Chicago dist. mill	1.85	1.85	1.85	1.65
Wire nails, Pittsburgh	2.35	2.35	2.10	1.95
Wire nails, Chicago dist. mill	2.40	2.40	2.15	2.00
Plain wire, Pittsburgh	2.20	2.20	2.10	2.20
Plain wire, Chicago dist. mill	2.25	2.25	2.15	2.25
Barbed wire, galv., Pittsburgh	2.85	2.85	2.60	2.60
Barbed wire, galv., Chicago dist. mill	2.90	2.90	2.65	2.65
Tin plate, 100 lb. box, P'gh	$5.25	$5.25	$4.65	$4.25

Scrap

Per Gross Ton:				
Heavy melting steel, P'gh	$12.50	$12.50	$11.50	$8.75
Heavy melting steel, Phila	**11.00**	10.75	9.75	6.75
Heavy melting steel, Ch'go	**9.75**	8.75	8.50	5.25
Carwheels, Chicago	**10.00**	9.50	9.00	7.00
Carwheels, Philadelphia	**11.75**	10.75	10.75	8.00
No. 1 cast, Pittsburgh	11.25	11.25	11.25	9.50
No. 1 cast, Philadelphia	**12.50**	12.75	11.25	8.00
No. 1 cast, Ch'go (net ton)	**9.50**	8.50	8.50	6.25
No. 1 RR. wrot., Phila	11.00	11.00	11.00	7.50
No. 1 RR. wrot., Ch'go (net)	**8.50**	7.50	7.25	4.00

Coke, Connellsville

Per Net Ton at Oven:				
Furnace coke, prompt	$3.75	$3.75	$3.75	$1.75
Foundry coke, prompt	4.25	4.25	4.25	2.50

Metals

Per Lb. to Large Buyers:	Cents	Cents	Cents	Cents
Electrolytic copper, refinery	8.00	8.00	8.00	4.75
Lake copper, New York	8.25	8.25	8.25	5.00
Tin (Straits), New York	52.87½	53.20	53.25	22.80
Zinc, East St. Louis	4.45	4.50	4.50	3.12½
Zinc, New York	4.80	4.85	4.85	3.49½
Lead, St. Louis	4.05	4.05	4.15	2.87½
Lead, New York	4.15	4.15	4.30	3.00
Antimony (Asiatic), N. Y.	7.25	7.25	7.25	5.40

On export business there are frequent variations from the above prices. Also, in domestic business, there is at times a range of prices on various products, as shown in our detailed price tables.

▲ ▲ ▲

▲▲▲ The Iron Age Composite Prices ▲▲▲

	Finished Steel	Pig Iron	Steel Scrap
Dec. 26, 1933	2.028c. a Lb.	$16.90 a Gross Ton	$11.08 a Gross Ton
One week ago	2.028c.	16.90	10.67
One month ago	2.015c.	16.61	9.92
One year ago	1.948c.	13.56	6.92
	Based on steel bars, beams, tank plates, wire, rails, black pipe, sheets and hot-rolled strips. These products make 85 per cent of the United States output.	Based on average of basic iron at Valley furnace and foundry irons at Chicago, Philadelphia, Buffalo, Valley and Birmingham.	Based on No. 1 heavy melting steel quotations at Pittsburgh, Philadelphia and Chicago.

	High	Low	High	Low	High	Low
1933	2.036c., Oct. 3	1.867c., Apr. 18	$16.90, Dec. 5	$13.56, Jan. 3	$12.25, Aug. 8	$6.75, Jan. 3
1932	1.977c., Oct. 4	1.926c., Feb. 2	14.81, Jan. 5	13.56, Dec. 6	8.50, Jan. 12	6.42, July 5
1931	2.037c., Jan. 13	1.945c., Dec. 29	15.90, Jan. 6	14.79, Dec. 15	11.33, Jan. 6	8.50, Dec. 29
1930	2.273c., Jan. 7	2.018c., Dec. 9	18.21, Jan. 7	15.90, Dec. 16	15.00, Feb. 18	11.25, Dec. 9
1929	2.317c., April 2	2.273c., Oct. 29	18.71, May 14	18.21, Dec. 17	17.58, Jan. 29	14.08, Dec. 3
1928	2.286c., Dec. 11	2.217c., July 17	18.59, Nov. 27	17.04, July 24	16.50, Dec. 31	13.08, July 2
1927	2.402c., Jan. 4	2.212c., Nov. 1	19.71, Jan. 4	17.54, Nov. 1	15.25, Jan. 11	13.08, Nov. 22

Pittsburgh District Steel Production Is Maintained

Output Also Sustained in Valleys and Higher at Wheeling—December Finished Steel Shipments Best in Fourth Quarter

PITTSBURGH, Dec. 26.—Aggregate steel shipments in December will probably exceed those of November and October, and will surpass the movement in any previous December during the past several years. This unusual record will have been scored without notable support from the automotive industry, which in preceding months had been the sustaining factor in demand. Although producing departments still are being pushed to meet the final shipping date against fourth quarter contracts, it is not likely that much unshipped tonnage will have to be written off order books on Jan. 1.

Steel producers, as a consequence of the heavy flow of December specifications, will face the first quarter with scant backlogs. Nevertheless, sentiment at the turn of the year is more buoyant than it has been in many months. Current optimism is partly justified by prospects of heavy railroad business and the reentry of the motor car makers in the steel market next quarter. Maturing of additional public works projects is also cited in the forecasts of forward business.

Most mills resumed operations today at the same rate which prevailed last week. Ingot output in the Pittsburgh district is holding at 28 per cent of capacity. In the Valleys and nearby Northern Ohio mills, production is slightly higher at 38 per cent. Output in the Wheeling district has been raised five points to 50 per cent. Blast furnace operations in the Pittsburgh area are unchanged. A steel company stack at Columbus, Ohio, will be blown in on Jan. 1.

The scrap market, although devoid of buying activity, still is buoyant.

Pig Iron

Releases of tonnage against low-priced pre-code contracts have generally been furnished, and unshipped balances on Jan. 1 will be small. Small fill-in purchases of foundry grades represent the only new buying in this market. Basic and Bessemer consumers still are not displaying any interest. All current quotations will apply through first quarter.

Semi-Finished Steel

Movement of billets, blooms and slabs to non-integrated steel mills is practically arrested as the year-end approaches. Most mills are drawing on stocks for current requirements, and little new covering is expected until late in January. Sheet bars and wire rods, which recently have been moving briskly, are beginning to feel the influence of tapering mill schedules. Forging billets are very quiet. Skelp is likewise dull.

Bars

Hot-rolled bar mills are concentrating production on final specifications against fourth quarter orders placed at 1.60c., Pittsburgh. Completion of these commitments by the shipping deadline on Dec. 31 is considered likely to be accomplished in most cases. The 1.75c., Pittsburgh, price, which was named early this quarter on spot and first quarter business, will become uniformly established on Jan. 1. The recent flood of anticipatory covering at the old price will undoubtedly augment already ample stocks. Further covering will probably not be important until well into the next quarter.

Shipments against all reinforcing steel specifications that do not cover an identified project must be made by Dec. 31. Little difficulty will be encountered in meeting the deadline. Fresh specifications of recent date are rather meager. About 300 tons of reinforcing steel will be required for the Oywhee project at Dunaway, Ore., on which bids were opened Dec. 26 by the Bureau of Reclamation, Department of the Interior, Denver. A moderate tonnage of bars is needed for approaches and piers for Government bridges over Cape Cod Canal at Sagamore and Bourne, Mass. Major awards in the past week were scarce. Billet steel reinforcing bars in stock lengths as quoted by distributers will be held at 1.80c., Pittsburgh base, for first quarter.

Plates and Shapes

Prospects for plate demand are limited mainly to expected railroad car and equipment purchases. Very little new tank work has appeared. The barge market is currently bare of important demand for plates. A few scattered repair jobs comprise the only activity in barge yards. The $2 a ton advance in plates early in the quarter is believed to have caused deferment of some barge building. Completion of practically all plate orders placed at 1.60c., Pittsburgh, will be effected on Dec. 31 and the 1.70c. price will become effective on all business on and after Jan. 1 through the coming quarter.

Structural steel orders in the past week were in diminished volume. New projects are featured by two highway bridges over Cape Cod Canal, for which approximately 12,000 tons of structural shapes will be required. Bids on that project will be taken by the War Department on Jan. 3. Other new work is unimportant with regard to tonnage, with the exception of a substructure for a parcel post building at Boston and State hospital buildings at Brentwood, N. Y., which will require 1200 tons and 1800 tons respectively.

Rails and Track Accessories

Inquiries for these products continue to be brisk. Actual placement of orders, however, is impeded by countless details that enter into negotiations, which embrace new practices under the steel code and many Federal dictates covering PWA loans to the carriers. Untangling of the attendant red tape is thus forestalling some tonnage which might be welcome to mills early next month. A producer in the Wheeling district received a large share of the Pennsylvania Railroad's recent order for track accessories. No important railroad tonnage, however, has reached Pittsburgh producers in the past week. The local rail mill has not been actively engaged recently.

Wire Products

Scattered orders are still being placed in anticipation of higher prices to rule on first quarter business. In some producing departments, schedules are being pushed in order to meet the final shipping date on current contracts. Wire mills early this week are averaging 35 to 40 per cent of capacity. On Jan. 1 code regulation No. 3, applying to merchant items of wire products, will become uniformly effective. Under that regulation, all original jobbers' agreements will be automatically canceled. The new agreement will not merely bind a producer and a jobber, but will require that a jobber adhere strictly to its terms with all producers of merchant wire products. The new form of agreement is intended to place all legitimate jobbers on an equal basis and to eliminate any discrimination that might have crept in under the present type of agreement.

Tubular Products

Pipe mills are not being pressed to meet the final shipping date on fourth quarter contracts. Recent business has been extremely light. The only pos-

sible exception is in the case of seamless boiler tubes, which were relatively active in the past week as a result of covering against lower discounts to rule on first quarter tonnage. Further Federal restriction covering oil production in January is tending to depress oil country goods. Routine drilling, however, is providing a small demand for drill pipe and casing. The gradual improvement in financial positions of oil producers, growing out of higher prices for oil, is expected to be reflected in due time in a greater demand for pipe.

Sheets

Moderate tonnages of finished sheets have been booked for January. General interest, however, is not expected to spread until after the inventory period. The automotive industry is still harassed by production difficulties, and little support from that source is in prospect for many weeks. Miscellaneous requirements are not important at the moment.

Tin Plate

One or two mills will experience difficulty in shipping out 1933 tonnage by Dec. 31. In other cases where the pressure is not so great, hot-rolling against some 1934 orders is sustaining the general average for the tin plate group, which is holding at 75 per cent of capacity. A precipitate drop from that rate, however, is in prospect toward the close of the year.

Strip Steel

Scattered tonnage is still coming in from motor car makers and implement manufacturers. A tapering of strip mill operations will attend the final week of December, however, and, with first quarter tonnage bookings light, January mill schedules will probably level off. Hot-rolled strip will be quotable at 1.75c. and cold-rolled strip at 2.40c., Pittsburgh, for first quarter.

Cold-Finished Bars

A few last-minute specifications against present contracts are dribbling in. Specifying last week was rather brisk, but producers are experiencing no hardship in scheduling shipments to meet the Dec. 31 deadline. On Jan. 1, cold-finished bars will be uniformly established at 2.10c., Pittsburgh, for first quarter.

Coke and Coal

This market is characteristically quiet at the year-end. Furnace and foundry grades of coke are practically being ignored. Bituminous coal is extremely quiet. Accumulations of slack are mounting, and shippers are experiencing considerable difficulty in finding destinations for tonnage.

Scrap

With large consumers generally covered for the remainder of the year, buying activity has subsided. The current brisk pace of mill operations is accounting for a good movement of scrap, and dealers will consequently enter the new year with order books fairly well cleaned up. Further important buying, however, will await more definite prospects of first quarter business. Notwithstanding the tapering of demand, scrap prices are maintaining recent firmness, largely because of buoyant business sentiment. Several grades are slightly higher. Dealer offering prices for railroad specialties are 50c. a ton higher, and low phos billet crops have advanced 25c. on a recent sale. Approximately 67,000 tons of scrap has been purchased in the past two months by an Ohio consumer for delivery through January to its several plants. Negotiations for this material were concluded several weeks ago. The bulk of the purchase covered No. 1 and No. 2 heavy melting steel, but smaller amounts of specialties, rails, wheels and turnings were included.

Scrap Advances at St. Louis

ST. LOUIS, Dec. 26.—Scrap is higher this week on the strength of direct buying and purchases through dealers by an East Side mill, and covering of short interests by dealers. Selected heavy steel, No. 1 heavy melting, miscellaneous standard section rails, No. 2 railroad wrought, rails for rolling, steel car axles, and wrought iron bars and transoms are 25c. a ton higher, and No. 2 heavy melting and cast iron carwheels are up 50c. a ton.

Buying of pig iron has been better than had been expected. A number of rush orders have come from melters whose consumption had been greater than they had anticipated. First quarter contracting has not yet developed.

Railroads centering here have asked for prices for first quarter on plates, bars, shapes and sheets. Mills are looking forward to heavy railroad buying during the early part of 1934.

John Meltzer, Inc., New York, is the low bidder on the general contract for the Government dam at Saverton, Mo., bids for which were opened last Thursday at Hannibal, Mo., requiring 869 tons of structural steel and 650 tons of reinforcing bars. J. A. Tobin of Kansas City is the low bidder on the general contract for the Seventh Street Viaduct at Kansas City, requiring 1200 tons of structural steel. Kansas City's city manager has recommended the award of the general contract for its municipal auditorium, requiring 6000 tons of structural steel, to Boaz-Kiel Construction Co., St. Louis, and Boyle-Prior Construction Co. of Kansas City.

Rail and Car Orders Expected in the South

BIRMINGHAM, Dec. 26.—Pig iron shipments have continued steady with no interruption except for the holiday. Most foundries with lower-price contracts have taken as much iron as they could finance. The outlook for January and February buying is doubtful on account of the stocking that has taken place during the past two and three months.

Ten furnaces are active, no change in number having been made since Dec. 7. The Tennessee Coal, Iron & Railroad Co. switched its Ensley No. 5 from foundry to ferromanganese on Dec. 18. Republic Steel Corpn. will probably bank one of its furnaces at the end of this week.

Steel

The activity in wire products that developed during the first two weeks of December, following the announcemen of higher prices for January, has subsided, but sufficient business was booked to keep production and shipments at a high point until the end of the month. Mill schedules have been increased so as to fill these orders before the last day of December. Sheet demand has been growing and satisfactory business is in sight through January. Other steel products are more or less sluggish.

Pullman Car & Mfg. Corpn., whose plant at Bessemer, Ala., has not operated regularly for more than two years, is hopeful of securing a car order from Central of Georgia Railway, which would enable the Bessemer works to resume on a fair schedule. The Central of Georgia is planning to order 200 70-ton coal cars. This line is also expected to buy 3000 tons of rails and 900 tons of rail accessories at an early date.

Twelve open-hearths were worked in the district last week and the same number will probably be active during the present week.

Detroit Scrap Prices Advance

DETROIT, Dec. 26.—With prospects bright for increased steel operations during the first quarter and with dealers reluctant to take orders until scrap production expands, old material prices have advanced 25c. to 50c. a ton. Heavy melting steel, hydraulic bundles and most other steel items are up 50c. a ton. The local steel company has bought scrap the past week, paying the higher prices asked by dealers. Dealers, fearing that they will get caught in an advancing market, are avoiding rather than soliciting orders.

Chicago Ingot Rate Holds at 40 Per Cent

Pressure for Shipments Is Strong—Scrap Advances on a Wide Front—200,000 Tons of Steel Required for Pending Equipment

CHICAGO, Dec. 26.—The Chicago iron and steel market continues in its unnatural course as users press to obtain the last pound due them before midnight of the 31st. Ingot output, halted during Christmas day, has been raised several points on a daily basis, leaving the production for the week at the unchanged rate of 40 per cent of capacity.

What the output will be, early in January, is almost anybody's guess. General demand for bars is better and foundry melt is undeniably better. Some automobile manufacturers are taking more steel and Government programs are swelling current shipments. Agricultural implement plants are slightly more liberal than heretofore in the matter of specifications. On the whole, there is some prospect that the early January drop in shipments may not be so sharp as was expected when the rush against old contracts first started.

The scrap market remains unusually strong, and not only have mills come in for tonnages at new price levels, but dealers continue to scramble for available tonnages and bidding is spirited. While some dealers think scrap has been subjected to too much market pressure, others believe that prices will go still higher. This last view is evidently shared by the railroads, which are holding on to most of the scrap gathered in recent months.

Steel producers are closely following developments in the railroad equipment field. They estimate that more than 200,000 tons of steel will be needed for programs that have already been announced and they are confident that other work of this kind will appear before spring.

Pig Iron

Shipments of Northern foundry iron continue to grow. Sellers also find that interest in forward buying is expanding. Melters in western Michigan are pouring more iron, and foundries making castings for machine tool builders are promised more work as the result of orders from automobile builders.

Cast Iron Pipe

Preliminary estimates on the pipe to be purchased by the Sanitary District, Chicago, placed its value at $2,500,000. Numerous small lots of pipe are being rushed out to all parts of the Central West to be used on work being done by the CWA. Delivered prices at Chicago are firm at $44 to $45 for 6-in. and larger diameters. Wilmette, Ill., is taking additional figures on various classifications of pipe not called for in the original specifications.

Warehouse Business

Orders have gradually declined as December has advanced, but the recession has not been more than seasonal. On the whole this month's business is running well above the volume of December, 1932. The next few weeks, or until about Jan. 15, orders are expected to be light because of the influence of the inventory period.

Reinforcing Bars

Awards are not of great importance, but prospective tonnages are piling up fast on public works of all kinds. Numerous small orders for CWA projects are being rushed out to locations where the men are at work. Mesh is the most popular commodity for undertakings of this kind. Bars for the dam at Quincy, Ill., have been ordered, and a hospital building at Fort Knox, Ky., is taking 150 tons. The Sanitary District, Chicago, now has public funds available but it is expected that contractors will balk at fulfilling old contracts which were figured on lower costs for materials than are now available.

Plates

Dams across the Mississippi River still hold first place in the local plate market. However, prospects for railroad equipment continue to improve. About 200,000 tons of steel will be needed for the equipment that will be bought by the Chesapeake & Ohio, the Erie and the Nickel Plate. The Erie is also planning on 133 passenger cars. Plate fabricators are holding stocks to the minimum, preferring to buy as needs arise rather than take chances on sizes and absorb the loss on wastage.

Structural Material

Outstanding among structural awards is 2500 tons for a dam across the Mississippi River at Alton, Ill. This job also takes 8000 tons of steel piling. Similar projects on which bids have been opened will take 4000 tons of structural shapes and 5000 tons of piling. Inquiries include two warehouses, one to be built at St. Louis and the other at San Antonio, Tex. All other requests for prices are for highway bridges, the largest single inquiry being by the State of Illinois for 900 tons.

Bars

Specifications from all sources remain in good volume. Agricultural implement manufacturers are buying limited quantities and their specifications are slightly heavier. The outlook in their field is considered good. Automobile builders are drawing more heavily against bolt and nut makers, and accessory manufacturers are slowly getting under way. Forge shops in the Chicago area have lost little production ground in December. Forward contracting for bars still drags, with little prospect for a material gain until after the turn of the year.

Cold-Drawn Bars

Specifications for this commodity, as for all other finished steel products, are up sharply as users attempt to clear old low-priced commitments before Jan. 1, when the new quotation of 2.15c a lb., Chicago, becomes fully effective. Some consumers have been able to estimate future needs, but on the whole forward contracting is not on a large scale.

Wire Products

The rush to take out fourth quarter commitments has not abated. Specifications for the past three and a half weeks have been at a rate of three times that of December, 1932, and at least double that of last month. Manufacturers and jobbers are sharing alike in this upturn. Dealers throughout most farm areas have been encouraged by an improvement in their collections and, with their credit on a firmer basis, are taking in more goods. Jobbers, in turn, are ordering more freely from mills. New buying is on a broader scale, though forward contracting has much ground to cover before books will be of large size. Jobbers' agreements are being rather generally accepted and this factor contributes to the better feeling. The next important turn is looked for in January when automobile manufacturers are expected to enter the market.

Rails

Several Western railroads have cleared the way for their rail programs as far as satisfying the requirements of the I.C.C. are concerned. Among these are the Chicago & North Western, Chicago & Eastern Illinois and the Milwaukee road. There are still other hurdles to take before orders will be placed. The Milwaukee road is said to have made tentative allot-

ments for a total of 50,000 tons of rails, though it is not yet in position to place formal orders. Local rail mills have small releases, which are affording limited output.

Scrap

Dealers are in a mad scramble for most grades of scrap and prices are soaring. Heavy melting steel has moved up to $10 a ton on dealer trades and as high as $10.25 has been paid for a few odd cars. These prices are strong and may not be the top for the current movement, though some dealers are beginning to think that the pressure is too severe and cannot long be sustained. Mills, well supplied with immediate needs, are standing by, the highest price paid by any of them being $9 a ton. It is rather doubtful if an actual shortage of scrap exists. Dealers are known to be hoarding scrap against higher consumer prices, and consequently it is extremely difficult to cover unfilled orders. The Burlington appears to be on the verge of disposing of 2000 tons, but the Santa Fe, with large supplies on hand, is waiting. Foundries are pressing harder for deliveries, not so much because of immediate needs but from fear that delays in shipments may catch them short of certain grades.

Holidays Fail to Depress Business at Boston

BOSTON, Dec. 26—Despite the holiday season, the scrap market has held its own. Sales of carlots of No. 1 heavy melting steel, steel turnings, No. 2 steel, forged scrap and punchings for eastern Pennsylvania and Pittsburgh district delivery have been slightly more numerous. This business, added to 1000 tons of melting steel loading at Charlestown, Mass., for export via New York and an occasional car of material for consumption at New England points, made the past week the most active experienced by the local trade in some time. New England stocks of scrap, generally admitted to be well below those of 1929, probably will be liquidated rapidly when a favorable price level is reached.

Business in pig iron has been confined largely to shipments on old contracts. It is estimated that fully 80 per cent of the so-called "active" foundries have signed contracts for their first half by-product foundry coke.

Federal and State work in Massachusetts the past week has brought 12,575 tons of structural steel projects into the market, raising the amount of pending business to an aggregate of 14,000 tons, the largest total in a long time. Temporary funds of the CWA have run out and cast iron pipe bookings have fallen off. But pipe plants are busy making shipments. The local foundry of the Warren Foundry & Pipe Corpn. has increased its schedule from five to six days a week.

Steel Output Higher at Buffalo

BUFFALO, Dec. 26.—The Lackawanna plant at the Bethlehem Steel Corpn. has increased the number of its active open-hearths to nine. Republic continues to operate four, including a 200-ton furnace, and Wickwire-Spencer, two. The Seneca sheet division of Bethlehem is still on a 40 per cent basis.

New pig iron sales are light, but this month is expected to be one of the heaviest months in shipments in years. This is due to the ruling that all iron now on order must be shipped by Jan. 1.

In the scrap market a sale of 3000 to 5000 tons of No. 1 and No. 2 melting steel is reported to have been made to a local mill at around $9.50 for the No. 2 and $10.50 for the No. 1. Another sale of approximately 1500 tons of cupola cast and stove plate was entered at $10 and $9 respectively. All prices are firmer. Dealers believe that the largest district consumer will come into the market soon.

Reinforcing Steel

Awards 4020 Tons—New Projects 9800 Tons

AWARDS

Monroe, Genesee, and Steuben Counties, N. Y., 450 tons, road mesh, to American Steel & Wire Co.

Queens County, N. Y., 150 tons, grade separation, to Capitol Steel Corpn.

Westchester County, N. Y., 275 tons, road mesh, to Concrete Steel Co.

Wilmington, Del., 420 tons, high school, to Kalman Steel Corpn.

Jamaica Plain, Mass., 120 tons, monastery, to Kalman Steel Corpn.

Quincy, Ill., 375 tons, dam across Mississippi River, to Laclede Steel Co.

Fort Knox, Ky., 150 tons, hospital buildings, to Concrete Engineering Co.

Mojave County, Ariz., 160 tons, State paving, to an unnamed bidder.

State of Montana, 145 tons, bridges in four counties, to unnamed bidders.

State of Washington, 100 tons, State paving, to unnamed bidder.

State of Oregon, 110 tons, highway bridges in nine counties, to various bidders.

San Francisco, 600 tons, Federal building, to Truscon Steel Co.

State of California, 210 tons, highway work in eight counties, to unnamed bidders.

Mare Island, Cal., 300 tons, magazines at Navy Yard, to Gunn-Carle Co.

Santa Rosa, Cal., 100 tons, bridge over Russian River, to Truscon Steel Co.

Pearl Harbor, Hawaii, 250 tons, facilities building at Navy Base, to Pacific Coast Steel Corpn.

Canal Zone, 100 tons, material for Navy Base, Specifications No. 2914, to an unnamed bidder.

NEW REINFORCING BAR PROJECTS

Quincy, Mass., 500 tons, Fore River bridge foundations.

San Francisco, 400 tons, approach pier on Trans-Bay bridge, bids Jan. 3.

Los Angeles County, Cal., 205 tons, material for Verduga Wash conduit; bids under advisement.

Los Angeles County, Cal., 100 tons, channel on Arroyo Seco; bids under advisement.

State of California, 5925 tons, canals on Central Valley Water Project; bonds approved.

Portland, Ore., 2300 tons, side dam at Bonneville; bids Jan. 3.

Gloucester City, N. J., 350 tons, Government building.

Pipe Lines

New York & Richmond Gas Co., St. George, Staten Island, N. Y., is considering extensions in gas pipe line system, including new storage and distributing station. Cost over $85,000.

Leesburg, Fla., plans steel pipe line for gas distribution in connection with new artificial gas works. Fund of $80,000 is being arranged for entire project through Federal aid. W. Austin Smith, Jacksonville, Fla., is consulting engineer.

Delcambre, La., plans steel pipe line system for natural gas distribution in municipality. Cost $27,234. Application made for Federal loan.

Iowa Power & Light Co., Davenport, Iowa, has authorized high-pressure welded steel pipe line, 3-in. and larger, from connection with main trunk line of Natural Gas Corpn. of America, for natural gas supply at Oskaloosa, Iowa, totaling about 11,000 ft.; also will make extensions and improvements in city distribution lines for new service, and installation of new equipment at distributing plant.

Halstead, Kan., takes bids soon for natural gas steel pipe line. Cost $30,000. Devlin Engineering Co., W-K-H Building, Wichita, Kan., consulting engineer.

Oklahoma Western Gas Co., Cushing, Okla., R. M. Tuttle, president, plans steel pipe line for natural gas trunk and distributing service near Cushing. Cost $1,474,325. Financing is being arranged through Federal aid.

A 200-page book, profusely illustrated and bound in stiff covers, has been issued for general distribution by Demag Aktiengesellschaft, Duisburg, Germany, to show the scope and variety of the structures and machinery the company has built for use in different parts of the world. Most of the volume pictures what the company has done in the field of mining and quarrying, in the building of blast furnaces, steel works and rolling mills, in the manufacture of gears for industrial purposes, in the design and erection of steel buildings and bridges, and in the equipment of shipyards and harbors, including varieties of cranes and excavating machines. The publication besides being an illustration of high-class book work is impressive in respect to the facilities of the company to supply modern, efficient machinery and equipment for a wide division of the whole metal-working industry.

Finishing Mills Taxed In Cleveland Area

Ingot Output, However, Drops Back to 47 Per Cent—Shipping Orders Against Pig Iron Contracts Are Heavy

CLEVELAND, Dec. 26.—Specifications for steel bars, plates and shapes have continued heavy the past week, and mills have received orders for practically all of the tonnage due on these contracts placed at the old prices. Finishing mill operations have been increased in order to ship the steel out by Dec. 31, the deadline date. Some bar mills have started up that have not operated for a year or more. Producers expect to be able to ship out all of this steel this week. In a few cases consumers have needed steel in excess of the amount covered by these contracts and have placed additional tonnage at the new prices.

With the rush of specifications during the past two weeks, the volume of business in December will show an increase over both October and November. Ingot output in the Cleveland-Lorain district dropped five points this week to 47 per cent of capacity, losing the gain that was made the previous week. Two producers shut down their steel plants three days for the holiday period, but another remained in operation.

As the new year will start with most consumers supplied with good stocks of bars, plates and shapes and with not much tonnage on the mill order books, activity in these products is expected to be quite limited during January. The same lack of activity probably will apply to wire products, for which specifications against contracts have been quite heavy because of the higher prices that become effective Jan. 1. As prices of sheets and strip steel have not been changed for the coming quarter, consumers have had no incentive to specify for these in excess of their normal requirements.

Shipping orders against old low-priced pig iron contracts have continued heavy and many consumers will start the new year with large stocks.

Following advances in other districts, local scrap prices have been marked up.

Pig Iron

Specifications against old low-priced contracts continue fairly heavy and producers are accepting orders that are received in time to make shipments from their stock piles up to and including Dec. 30. While most consumers are taking all the iron due on their contracts, there are a few who will allow the cancellation of some of their tonnage at the end of the month. The effect of the rush to take in iron against expiring contracts is expected to be felt sharply during the first few weeks of the new year, as new orders will be light until foundry stocks are well used up. Contracting for the first quarter has subsided.

Sheets

The market has shown a little more life in that new demand for small lots has gained slightly. These orders, for the most part, have been for early January deliveries. While some of the tonnage came from the automotive industry, none of the orders was large. Few consumers are showing interest in first quarter contracts.

Strip Steel

Demand showed further slight improvement during the week. Some small-lot fill-in orders came from the automotive industry and the remaining business from miscellaneous sources. Brewery work and beer-dispensing equipment are bringing out business in alloy and stainless cold-rolled strip. Some first quarter contracts have been placed.

Wire Products

The higher first quarter prices have driven in heavy specifications against fourth-quarter contracts. Mill stocks have been reduced to a low point and, in the absence of new business after Jan. 1, operations can be maintained at a fairly good rate to replenish these stocks.

Bars, Plates and Shapes

With fourth quarter contracts cleaned up, the present prices will apply on all business. These are 1.80c., Cleveland, for steel bars and 1.70c., Pittsburgh, for plates and shapes. The only sizable structural award was 500 tons placed during the week by a Cleveland contractor for a Pennsylvania highway bridge. Several Ohio bridge jobs are pending requiring small lots of reinforcing bars.

Scrap

Recent purchases by a Cleveland mill have given the local market a firmer tone. Dealers are paying as high as $9.50 for No. 1 heavy-melting steel for shipment against local orders that they took at the same price. This is an advance of 50c. a ton from the recent minimum. Blast furnace scrap has advanced 25c. to 50c. a ton. For delivery against recent Youngstown orders dealers are paying $11.75 to $12 for No. 1 heavy-melting steel.

Construction Work Active On Coast

SAN FRANCISCO, Dec. 26.—At the polls the State of California has approved bonds in the amount of $170,000,000 for the construction of the Central Valley Water Project. The Kennett dam and reservoir, to cost approximately $60,601,000, will be 420 ft. high, 315 ft. thick at the base and 2430 ft. long on the crest. The Friant dam, while smaller, calls for an expenditure of $13,646,000. Complete steel tonnage estimates for the dams have not yet been released. Reinforcing bar estimates for the 157-mile Friant-Kern Canal and the Madera Canal are 3590 tons in the 41 siphons, approximately 1400 tons for the 183 bridges and an additional 925 tons for miscellaneous work. A minimum of 1132 tons of structural steel will go into the canal units. Several pumping and hydroelectric plants are included in the project. Approximately 10,000 tons of structural steel will be required for transmission lines.

Progress on the dam and power plant at Bonneville, Ore., is seen with the call for bids on Jan. 3 for the construction of the side dam in which 2300 tons of reinforcing bars will be used.

At Oakland, Cal., bids have been called for a county bridge which calls for 1480 tons of structural steel and 560 tons of reinforcing bars. Approximately 400 tons of bars will be required in a highway approach pier on the Trans-Bay bridge. Bids will be taken for this unit at San Francisco on Jan. 3.

New structural inquiries reported during the week aggregated 1384 tons while 8112 tons of reinforcing steel and 247 tons of plates were added to pending lists.

For the Federal building at San Francisco 600 tons of reinforcing bars was let to Judson-Pacific Co. That company also took 340 tons of shapes for an extension to pier No. 3 at Fort Mason, Cal., and 200 tons for magazines for the Navy Yard at Mare Island, Cal. Gunn-Carle Co. has been awarded 350 tons of reinforcing bars for magazines at Mare Island and at the bombing base at Hamilton Field,

Cal. At Los Angeles the Phoenix Iron Co. and Pacific Coast Steel Corpn. divided 193 tons of structural steel for the Metropolitan Water District. The latter company also booked 250 tons of bars for the facilities building at the Navy Base at Pearl Harbor, T. H.

National Cast Iron Pipe Co. has taken 194 tons of pipe at Alhambra, Cal., and Huntington Park, Cal., has awarded 421 tons of pipe to American Cast Iron Pipe Co.

Total lettings during the week were as follows: 5742 tons of structural steel, 2221 tons of reinforcing bars, 167 tons of fabricated plates, and 731 tons of cast iron pipe.

Southern Ohio Furnace to Be Blown In

CINCINNATI, Dec. 26.—The American Rolling Mill Co. will blow in one of its two stacks at Columbus, Ohio, on Jan. 2, for the production of merchant iron.

The usual year-end easing of business activity is reflected in a lessened pig iron demand, although shipments continue to be good. New business, during the past week, was limited to about 300 tons of foundry iron and about 200 tons of silvery in miscellaneous lots. A few foundries in Cincinnati report a slightly increased melt, but this is offset by lessened operations elsewhere in the district, so that the average melt shows no improvement. Expected price advances on Northern iron have failed to materialize.

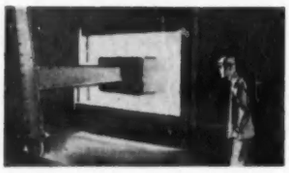
No definite demand for substantial coke tonnages has developed, but shipments against current contracts continue good.

Sheet demand has receded to about 30 per cent of mill capacity under the influence of inventory-taking. The turn of the year is expected to bring out renewed buying.

Scrap dealers have advanced bids another 25c. in sympathy with reported strength in other districts.

The subject, "Crystalline Structure in Relation to Failure of Metals—Especially by Fatigue," was chosen by Dr. H. J. Gough, superintendent, Engineering Department, National Physical Laboratory, England, as the basis for the 1933 Edgar Marburg lecture of the American Society for Testing Materials, presented at a joint session of the society and Section M (Engineering) of the American Association for the Advancement of Science. The lecture, which in published form aggregates 110 pages, constitutes a summary of our present-day knowledge of the nature of solid bodies. Bound in heavy paper covers, it can be obtained from A.S.T.M. headquarters, 260 South Broad Street, Philadelphia, at $1 a copy.

Finished Steel Buying Still Lags at New York



Railroad Car Repair Inquiry Expected Next Week—Lackawanna Places Rails and Track Accessories—Pig Iron Dull

NEW YORK, Dec. 26.—With local sales offices no longer accepting specifications against fourth quarter contracts, the market has lost the tension of the last fortnight and scarcely any activity can be expected this week. Quite a little tonnage has been turned down because of the inability of mills to make shipments by Dec. 31. However, this has been true only in the case of products on which higher prices become effective the first of the year, notably wire products, tin plate and bars. Demand for sheets continues light, but has remained fairly steady all month with the probability of improvement rather than a falling off in January.

The Chesapeake & Ohio, the Nickel Plate and the Erie have inquiries with the freight car builders for more than 12,000 cars. While the steel tonnage required has not been definitely estimated, 100,000 to 150,000 tons of rolled steel products will be needed. Action is temporarily delayed because of negotiations looking toward the purchase of alloy steel for a part of the requirements. Several Eastern roads are planning to purchase sizable quantities of steel for car repairs to be financed by the PWA, but inquiry will probably be postponed until after Jan. 1. The Lackawanna has purchased 12,000 tons of rails from the Carnegie and Bethlehem companies and 3000 tons of tie plates.

Public works projects may be spurred by the recent decision at Washington to withdraw allocation of funds for work which appears to be needlessly delayed. Two bridges in connection with the Cape Cod, Mass., ship canal will require 12,000 tons of structural steel.

Demand for tin plate has fallen off sharply with the year end, but a little contracting for the first half is reported. Mills have made no plans for January rolling schedules and most of them will not run during the first week.

Pig Iron

First quarter bookings in this district aggregated less than 1000 tons during the past seven-day period, compared with 1600 tons sold in the previous week, and 1700 tons booked a fortnight ago. Most melters are specifying practically all the material due them on old contracts, and December shipments will probably exceed those of any previous month in the year. No revival of consumer interest is expected until after the holiday and inventory period, and unless current foundry melt materially improves, the size of present yard stocks will discourage active buying until after the middle of the first quarter.

Reinforcing Steel

State highways and Federal projects continue to be the only support to the reinforcing steel market in this district. Awards during the week were concentrated in New York State, and about 1000 tons of bars and mesh for road construction and structures will be supplied by American Steel & Wire Co., Concrete Steel Co. and Capitol Steel Corpn. New York, Pennsylvania and Connecticut intend to place substantial tonnages within a fortnight and the general contractor for the Government building at Gloucester City, N. J., expects to sublet 350 tons of bars during the week.

Scrap

Buying is lacking in this district, but the market undertone is decidedly stronger. Brokers continue to pay $7.50 and $6.50 a ton for No. 1 and No. 2 heavy melting steel, but several purchases against export accounts were made at $8 and $7 respectively during the week. Export loadings are currently hampered by inclement weather and the disinclination of many yards to release important tonnages of steel at present price levels. Buyers abroad are avoiding new commitments at the present time, but local exporters expect the stronger tone of the domestic market soon to force foreign representatives to meet the higher prices. Jersey City is gaining favor as a shipping point, as many dealers prefer trucking to that point instead of loading at New York. Brokers are paying $8 to $8.25 a ton at Jersey City for heavy breakable cast for shipment to eastern Pennsylvania, and the local buying price is 25c. higher at $7.25 a ton. Recent activity in cupola grades advanced No. 1 machinery cast to $7.50. A sizable tonnage of No. 1 machinery cast was recently sold to a local melter at $9.50 a ton.

Eastern Pennsylvania Steel Output Again Rises Sharply

Production at 31 Per Cent of Capacity as Mills Rush Shipments Against Old Contracts — New Buying Is Light

PHILADELPHIA, Dec. 26. — As 1933 draws to a close, mills in this district have again stepped up production. Tonnage is being rushed for shipment against contracts in order to complete billing before the first quarter rise in prices. Ingot output has been increased six points to 31 per cent of capacity.

Some buyers, not familiar with code requirements, were late in releasing contracts, with the result that deliveries will be carried over into the new year at the higher prices applicable to such lines as plates, shapes, bars and wire products. This tonnage, however, is light, as was that on which shipments could not be completed and were released belatedly. Mills report that they have not received cancellations in either instance.

The unusual situation which forced heavy shipments, brought about by code regulations, promises to be reflected in a temporary let-down in early first quarter business. A drop in output would follow unless the gap is filled in by new tonnage. It is doubtful if much railroad tonnage will be placed soon, but there is a prospect that material for PWA projects, now beginning to filter in, will soon show an upswing. This increase is not expected to be of a substantial character for a month or so. Code regulations do not place restrictions upon identified structures covered by quarterly contracts, so that releases at a later date will not be affected by price changes under such contracts.

Railroad requirements probably will not bulk large in this district until the Pennsylvania places tonnage in connection with its electrification program. Arrangements for the PWA loan of $84,000,000 for this purpose have been virtually completed, but indications are that sizable tonnages will not be placed until the second quarter. Included in the program are 7000 freight cars, calling for about 100,000 tons of steel.

Pig Iron

The heaviest shipments of the last quarter are being made by blast furnace operators in order to clean up old contracts before the end of the year. Both steelmaking and foundry grades are moving in large volume. The foundry melt, however, has sagged somewhat and it is understood that some of the tonnage now moving is being piled. Incoming requirements at pipe foundries, chiefly for PWA projects, are growing and are absorbing fair-sized stocks of iron.

Plates, Shapes and Bars

While new requirements are comparatively light, shipments against releases for completion in the last quarter are heavy, and mills are experiencing difficulty in meeting pressure from buyers for year-end delivery. January likely will see a sharp let-down, but it is expected that the slack soon will be taken up. The volume of tonnage for PWA projects gradually is growing, and final arrangements for the Pennsylvania Railroad's loan of $84,000,000 from the PWA for completing its electrification between Wilmington, Del., and Washington are practically completed. However, sizable tonnage requirements from this source are not expected to reach mills until the second quarter. The loan also involves about 100,000 tons for 7000 freight cars. Virtually all of the steel requirements will be placed in 1934, with a relatively small tonnage going over into 1935. John McShain, Philadelphia, was low bidder on an annex for the Library of Congress, Washington, calling for 750 tons of structural material. Bids will be opened Jan. 15 for the first subway unit in connection with the Delaware River bridge at Philadelphia, to be built by the Delaware River Joint Commission. Requirements for this unit total about 1000 tons.

Sheets

Substantial automotive buying is not expected until late in January, when tonnage for new models probably will begin to reach mills. Strips and sheets were exempted from price increases in the first quarter so that automobile makers have not shown any great interest in forward bookings. Increases in the higher finishes of sheets are probable.

Warehouse Business

Jobbers report that new business is holding up better than they had anticipated. The price of cold-finished steel bars will be increased $3 a ton, from 3.58c. to 3.73c. a lb., effective Jan. 1.

Imports

The following imports were received here last week: 7400 tons of iron ore from Tunis and 150 tons of the same product from Germany; 4000 tons of chrome ore from Portuguese Africa and 467 tons of the same product from British South Africa; 568 tons of pig iron from British India; 93 tons of steel tubes, 78 tons of steel bars and 23 tons of steel rods from Sweden.

Old Material

The market continues to gather strength and several grades have been advanced 50c. to $1 a ton. No. 1 heavy melting steel now is firm at $11, the former price of $10.50 having disappeared. A number of mills are buying and shipments are heavy. Dealers are becoming more reluctant to sell at prevailing levels and look for further increases soon, even though they may be checked by lessened mill activity early in January. Export movement is also giving strength to the market. The first cargo of scrap for England to leave this port in several years will be shipped this week.

Machine Tool Demand Better Last Month

THE November index of machine tool orders reached 82.8 according to the National Machine Tool Builders' Association. This volume was the best recorded for over two years, and represented a 20 per cent gain over October. The buying of equipment on the Navy schedule began in October and contributed greatly to the November improvement.

Arc-Welder With Four-Wheel Trailer Mounting

THE Universal type arc-welder utilizing the shunt inductor principle of arc stabilization in motor generator and gasoline engine driven models is now being made with four-wheel portable trailer mounting by the Universal Power Corpn., Clarkstone Road, Cleveland. This welder was brought out some time ago as a two-wheel trailer type.

The Universal generator with two cartridge ball bearings is flexibly coupled to a six-cylinder engine and mounted on a structural steel chassis equipped with balloon tires. An idling control responsive to the will of the operator permits the engine to run slowly when not welding, thus economizing on gasoline, oil and engine life. When ready to weld, the operator brings the equipment again to automatically governed speed.

Fabricated Structural Steel

Awards Lighter—New Projects in Good Volume

STRUCTURAL steel lettings the past week, which were mostly in small tonnages, totaled 11,825 tons, compared with 17,500 tons a week ago. The largest bookings were 3825 tons for the Mathieson Alkali Works at Buffalo, and 2500 tons for a dam across the Mississippi River at Alton, Ill. Sheet steel piling awards for dams at Genoa, Wis., and Alton totaled 11,110 tons. New projects of 21,950 tons compare with 14,400 tons last week and 12,500 tons two weeks ago. The outstanding new job is 12,000 tons for two bridges across Cape Cod Canal, Mass. The bulk of inquiries is for bridges and other public work. Awards for the week follow:

NORTH ATLANTIC STATES

East Berlin, Vt., 130 tons, highway bridge, to American Bridge Co.

Venango Borough, Pa., 430 tons, highway bridge, to McClintic-Marshall Corpn.

Canonsburg, Pa., 140 tons, highway bridge, to Lackawanna Steel Construction Corpn.

Washington, 390 tons, class room building for Howard University, to Bethlehem Fabricators, Inc.

Greene County, Pa., 500 tons, highway bridge, to Fort Pitt Bridge Works.

Buffalo, 3825 tons, Mathieson Alkali Works, Inc., to Virginia Bridge & Iron Co., Inc.

Norristown, Pa., 225 tons, tank supports, to Morris Wheeler & Co.

SOUTH

Greenwood, Miss., 100 tons, bridge, to Virginia Bridge & Iron Co.

CENTRAL STATES

Greenville, Mich., 170 tons, State highway bridge, to McClintic-Marshall Corpn.

Chicago & Northwestern Railroad, 350 tons, bridges at Allis and West Allis, Wis., to Strobel Steel Construction Co.

Genoa, Wis., 3100 tons, piling, to Inland Steel Co.

Green Bay, Wis., 150 tons, paper mill, to Wisconsin Bridge & Iron Co.

Alton, Ill., 2500 tons, dam across Mississippi River, to American Bridge Co.; also 8000 tons of sheet piling, to United States Steel Corpn.

Medicine Lodge, Kan., 325 tons, bridge, to Missouri Valley Bridge & Iron Co.

WESTERN STATES

Fort Mason, Cal., 695 tons, extensions to docks Nos. 1 and 3; 325 tons to Judson-Pacific Co., 370 tons to Bethlehem Fabricators, Inc.

PACIFIC COAST

State of Montana, 185 tons, bridge over Tongue River, to an unnamed bidder.

Park County, Mont., 235 tons, bridge over Yellowstone River, to Wisconsin Bridge & Iron Co.

Mare Island, Cal., 200 tons, magazines at Navy Yard, to Judson-Pacific Co.

Fort Mason, Cal., 340 tons, extension to pier No. 3, to Judson-Pacific Co.

McConnel, Cal., 100 tons, State undercrossing, to McClintic-Marshall Corpn.

Ventura County, Cal., 100 tons sheet piling, to an unnamed bidder.

State of Oregon, 115 tons, bridges in nine counties, to unnamed bidders.

Los Angeles, 195 tons, sections for Metropolitan Water District under Specification No. 18431, to Pacific Coast Steel Corpn. and Phoenix Iron Co.

Dishman, Wash., 350 tons, bridge, to American Bridge Co.

Pearl Harbor, Hawaii, 110 tons sheet piling, pier and quay walls, to an unnamed bidder.

NEW STRUCTURAL STEEL PROJECTS

NORTH ATLANTIC STATES

New York, 715 tons, bank building; Post & McCord, erectors.

Philadelphia, 1000 tons, first unit of subway connection with Delaware bridge; general contract bids to be opened Jan. 15 by Delaware River Joint Commission.

Washington, 750 tons, foundations for addition to Library of Congress; John W. McShain, Philadelphia, low bidder on general contract.

Sapling, Me., 150 tons, State highway bridge.

Sagamore-Bourne, Mass., 12,000 tons, two highway bridges over Cape Cod Canal; bids to be taken Jan. 3 by War Department.

Boston, 1200 tons, substructure for parcel post building.

Auburn, Mass., 260 tons, State highway bridge.

Ticonderoga, N. Y., 150 tons, State Armory.

Brentwood, N. Y., 1800 tons, Pilgrim State Hospital buildings.

Lawrence County, Pa., 250 tons, highway bridge; bids Jan. 5.

SOUTH AND SOUTHWEST

State of Oklahoma, 225 tons, highway bridges.

San Antonio, Tex., 200 tons, warehouse.

CENTRAL STATES

State of Illinois, 900 tons, six bridges.

Burlington, Kan., 450 tons, bridge.

Barber County, Kan., 350 tons, highway bridge.

St. Louis, 125 tons, warehouse.

WESTERN STATES

Veta, Colo., 140 tons, State highway bridge.

Logan County, Colo., 135 tons, State overhead crossing; bids Dec. 30.

State of California, 1135 tons, canals in Central Valley Water Project; bonds approved.

FABRICATED PLATE

AWARDS

Seattle, 150 tons, repair work on steamship Hamlin F. McCormick, to Todd Drydock, Inc.

NEW PROJECTS

Inglewood, Cal., 110 tons, pipe line; bids under advisement.

Mare Island, Cal., 100 tons, two boilers at Navy Yard; bids Jan. 18.

Cast Iron Pipe

Army Base, Boston, closed bids Dec. 22 on about 300 tons of class C including 3000 ft. of 16-in.

Blue Springs, Mo., plans 6-in. and smaller pipe line from Independence, Mo., to municipality for water supply. Fund of $106,000 is being arranged through Federal aid. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is engineer.

Rochester, N. H., has awarded 150 tons of 6 and 8-in. to Warren Foundry & Pipe Corpn.

Atlantic City, N. J., is considering 48-in. line through meadow district for water supply. Cost about $900,000. Application is being made for Federal loan in amount noted. J. H. Hackney is city engineer.

Newport News, Va., plans pipe lines for extensions in municipal water supply. Cost $96,000.

Sumter, S. C., has secured Federal loan for $66,000 for new pipe lines for water supply and improvements in pumping station. Work is scheduled to begin in January.

Elyria, Ohio, plans new trunk main in Lake Avenue for water supply. Cost $300,000. Application has been made for Federal loan in sum noted. Jack Powell is city engineer.

Macon, Ill., has awarded 250 tons to James B. Clow & Sons.

Sanitary District, Chicago, has secured a Federal loan and may use approximately $2,500,000 worth of cast iron pipe.

Cincinnati has awarded 2000 tons to United States Pipe & Foundry Co.

Sandusky, Ohio, is taking bids on 300 tons.

Rosiclaire, Ill., will take bids on 300 tons.

Board of Quindaro Township Commissioners, Welborn, Kan., Walter Brotherson, secretary, plans 13-mile pipe line on Leavenworth Road, from point near Kansas City, Kan., to Welborn and vicinity for water supply. Application has been made for Federal loan of $106,000 for work.

Ordway, Colo., plans pipe line for water distribution, replacing present wood pipe system. Federal loan of $90,000 has been secured for this and new water reservoir.

Cleveland, Okla., plans water pipe line system. Cost about $200,000, including deep-well pumping station. Financing is being arranged. P. S. Donnell, Oklahoma City, Okla., is engineer.

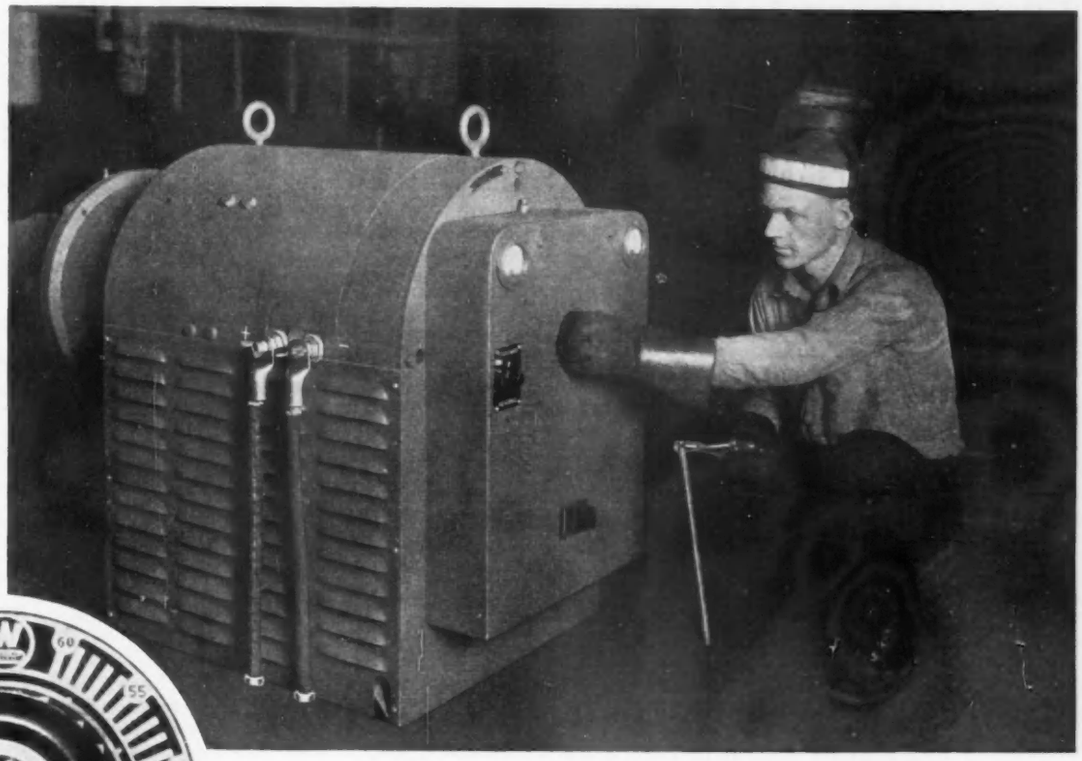
Hanford, Cal., will purchase 140 tons of 4-in. in open market.

Napa, Cal., has taken bids on 145 tons of 6 and 8-in.

Alhambra, Cal., has awarded 194 tons of 8-in. to National Cast Iron Pipe Co.

Huntington Park, Cal., has awarded 421 tons of 6 to 12-in. to American Cast Iron Pipe.

The spark test may be depended on as a means for classifying steels into groups of similar composition but cannot be successfully used as a means of identifying an unknown steel, according to R. W. Buzzard, who reports on studies made at the Bureau of Standards in research paper No. 605, obtainable from the Superintendent of Documents, Washington, at 5c. a copy. The pamphlet form of the report is replete with illustrations of the forms of sparks and the distinguishing forms of pellets collected from the spark streams. The spark test is regarded as the most rapid method for sorting mixed lots of steels containing such constituents as chromium, manganese, molybdenum, nickel, tungsten and vanadium.



(Right) *To make welding current adjustments, the operator simply turns a single dial on the Westinghouse FlexArc Welder.*

(Below) *The Single-Dial Control.*

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Poor Demand for Copper, Zinc, and Tin Reflects General Seasonal Inactivity

Moderate Lead Bookings Made at 4.15c., New York—Copper Remains Steady at 8.25c., Connecticut Valley—Zinc Quiet

NEW YORK, Dec. 26.—Prices for electrolytic copper were irregular during the past week. On Wednesday metal was priced at 8.37½c. a lb., Valley, for nearby positions, but the lack of domestic consumer support and weakness in the London market resulted in official offerings declining to a basis of 8.25c. for first quarter and 8.37½c. for full second quarter positions. Both first and second hand sellers are reluctant to press metal on the market, but a few second quarter commitments were made at 8.25c. during the week. Buying interest continues to lag, and the well covered position of most fabricators combined with a general holiday inactivity precludes any revival of trading until the early part of January. Code deliberations have been postponed until the new year, but the trade generally expects a public hearing and acceptance some time in January.

English and Continental consumption is maintained at a satisfactory level, but a seasonal slackening in buying is expected during the next fortnight. The London market is closed today, but American representatives succeeded in disposing of fair tonnages late last week at prices which ranged in cent equivalents from 8.50c. to 8.30c. a lb., c.i.f. usual Continental base ports. Buyers abroad are generally endeavoring to anticipate shipments because of the impending increase in transatlantic freight rates.

Tin

The New York price for Straits tin fluctuated less than 50 points during the trading period late last week, but buyers generally ignored market offerings. The current market is totally inactive because of holiday observances here and in London, and because of the closed London market Friday's quotation of 52.87½c. a lb. for spot Straits at New York was nominally effective today.

Zinc

Recent market weakness, resulting from an unbalanced ore production and a prolonged period of consumer inactivity, was reflected in a decline of 5 points to 4.80c. a lb., New York, or 4.45c., East St. Louis, for refined metal. The Prime Western market failed to react to the Government's silver policy. Only negligible tonnages of metal are being booked, and important sellers expect extreme market quietness to prevail until early January. Despite last week's price reduction, the present quotation is considered moderately steady on the strength of the refusal of major sellers to meet shaded bids of several important customers.

Lead

Recent market trading was characterized by a spurt in activity following the silver buying announcement at Washington, and most smelters were able to book tonnages well in excess of equivalent ore intakes. Buyers are generally interested in the January position, but several inquiries have been made for deliveries through February even though books are not yet open. Sellers anticipate fair activity in the immediate future as an estimated 10,000 tons remains to be sold for January delivery. Market quotations, however, continue somewhat unsteady at 4.15c. a lb., New York, and 4.05c., St. Louis, because of another rise in smelters' stocks during November. In order to maintain a healthy market for converted metal, many observers contend that production must soon be curtailed unless general consumptive demand rises sufficiently to restore a production-consumption balance. Visible stocks rose 13,100 tons to 187,800 tons in November, representing a 27,600-ton increase over the low point of Aug. 31. November production of 38,000 tons was 100 per cent greater than August output. Shipments in November were 30,700 tons as compared with the year's heaviest shipments of 45,000 tons during July.

Antimony

An extended period of lack of consumer interest brought about a 15 point decline in Chinese brands early last week. On Friday, however, the Administration's announcement of intent to purchase silver so strengthened Chinese currency that New York prices nominally advanced to 7.25c. a lb., f.o.b. basis. Chinese sellers have not cabled firm prices, and the market is consequently unsettled and untested. Recent purchases were entirely limited to prompt and early arrival positions.

The Week's Prices. Cents Per Pound for Early Delivery

	Dec. 20	Dec. 21	Dec. 22	Dec. 23	Dec. 26
Electrolytic copper, N. Y.*	8.00	8.00	8.00	8.00	8.00
Lake copper, N. Y.	8.25	8.25	8.25	8.25	8.25
Straits tin, Spot, N. Y.	52.75	52.40	52.87½	...	...
Zinc, East St. Louis	4.45	4.45	4.45	4.45	4.45
Zinc, New York	4.80	4.80	4.80	4.80	4.80
Lead, St. Louis	4.05	4.05	4.05	4.05	4.05
Lead, New York	4.15	4.15	4.15	4.15	4.15

*Refinery quotations; price ¼c. higher delivered in Connecticut.

Aluminum, 98-99 per cent, 22.90c. a lb., delivered; New No. 12, 18.50c. a lb., delivered.
Aluminum, remelt No. 12 (alloy), carload lots delivered, 12c. a lb., average for week.
Nickel electrolytic cathode, 35c. a lb., delivered; shot and ingots, 36c. a lb., delivered.
Antimony, 7.25c. a lb., New York.
Brass ingots, 85-5-5-5, 8.25c. a lb., New York and Philadelphia.

From New York Warehouse

Delivered Prices, Base per Lb.

Tin, Straits pig	55.00c. to 56.00c.
Tin, bar	57.00c. to 58.00c.
Copper, Lake	9.50c. to 10.25c.
Copper, electrolytic	9.25c. to 9.75c.
Copper, castings	9.00c. to 10.00c.
*Copper sheets, hot-rolled	15.00c.
*High brass sheets	13.75c.
*Seamless brass tubes	16.25c.
*Seamless copper tubes	16.25c.
*Brass rods	12.25c.
Zinc, slabs	6.00c. to 7.00c.
Zinc sheets (No. 9), casks	9.75c. to 10.00c.
Lead, American pig	5.12½c. to 6.12½c.
Lead, bar	6.12½c. to 7.12½c.
Lead, sheets	8.00c.
Antimony, Asiatic	8.50c. to 9.50c.
Alum., virgin, 99 per cent plus	23.30c.
Alum., No. 1 for remelting, 98 to 99 per cent	18.00c. to 19.00c.
Solder, ½ and ½	31.00c. to 32.00c.
Babbitt metal, commercial grade	25.00c. to 60.00c.

*These prices are also for delivery from Chicago and Cleveland warehouses.

From Cleveland Warehouse

Delivered Prices per Lb.

Tin, Straits pig	56.50c.
Tin, bar	58.50c.
Copper, Lake	9.125c. to 9.25c.
Copper, electrolytic	9.125c. to 9.25c.
Copper, castings	8.15c.
Zinc, slab	5.75c. to 6.00c.
Lead, American pig	5.00c. to 5.25c.
Lead, bar	8.00c.
Antimony, Asiatic	9.00c.
Babbitt metal, medium grade	19.75c.
Babbitt metal, high grade	61.25c.
Solder, ½ and ½	32.50c.

Old Metals, Per Lb., New York

Buying prices are paid by dealers for miscellaneous lots from smaller accumulators, and selling prices are those charged to consumers after the metal has been prepared for their uses. (All prices are nominal.)

	Dealers' Buying Prices	Dealers' Selling Prices
Copper, hvy. crucible	6.12½c.	7.12½c.
Copper, hvy. and wire	5.87½c.	6.87½c.
Copper, light and bottoms	4.87½c.	5.62½c.
Brass, heavy	3.37½c.	3.87½c.
Brass, light	2.87½c.	3.37½c.
Hvy machine composition	4.50c.	5.25c.
No. 1 yel. brass turnings	4.25c.	5.00c.
No. 1 red brass or compos. turnings	4.00c.	4.75c.
Lead, heavy	3.00c.	3.625c.
Zinc	2.50c.	3.00c.
Cast aluminum	7.25c.	8.50c.
Sheet aluminum	11.25c.	12.75c.

Light-Weight High-Speed Passenger Trains

(*Concluded from page* 33)

made of this train, varying somewhat the shape of the ends, these models being placed in a wind tunnel in order to arrive finally at the best shape to give minimum air resistance. Computations indicate that proper streamlining will reduce the power requirements at 100 miles an hour more than one-half as compared with the ordinary shaped railway vehicle. To get the full benefits of streamlining, the windows, of shatter-proof glass, are placed practically flush with the outside of the car; vestibules between cars are covered to continue the smooth sides of the cars; all such devices as headlights, tail lights, whistles, bells, etc., are recessed into the car body. A specially designed mechanism opens the doors and lets down folding steps for entrance to and exit from the car. The train is fully air conditioned, windows are sealed, and forced ventilation is used which will heat the train in winter, cool it in summer, filter all dirt and dust from the outside air, and, maintaining a pressure in the car, will exclude all dirt and cinders. The sealed windows, heavy body insulation, complete streamlining, liberal use of rubber in trucks, and the probable use of a resilient wheel will materially reduce noise.

A moden indirect lighting system is provided, giving uniform light reflected from the ceiling. The seats are the most comfortable that modern art has developed. Interior decorations are striking but simple. The train is completely equipped with modern roller bearings in order to reduce friction and avoid the necessity of terminal attention.

This train will consist of three cars articulated, i.e., one truck between each two cars and the cars hinged together. The purpose of such articulation is to save weight, first cost and friction of trucks, reduce cost of maintenance, and give a better riding quality by elimination of slack or motion between cars other than the hinge motion.

The first car contains a 600-hp., distillate-burning (a non-explosive fuel), internal-combustion engine with direct-connected electric generator and motors on the wheels of the forward truck, and also contains a 30-ft. railway post office and a baggage room. The second car is a coach seating 60 passengers. The rear car is also a coach seating 56 passengers, with a buffet at the rear end to serve light meals to passengers in their seats. This first train will not have any sleeping accommodations, but it is expected that the operation of the train will demonstrate its adaptability for the long transcontinental runs, and a car with sleeping accommodations has been designed.

Railroad Equipment

Central of Georgia was allotted $500,000 by the P.W.A. for purchase of 100 coal cars.

Boston & Maine has received $1,100,000 from the P.W.A. for locomotive, freight car, and passenger coach repairs.

Erie is inquiring for 75 all-steel suburban coaches, 50 through coaches, and eight combination cars.

Escanaba & Lake Superior has purchased from Fairbanks Morse & Co. a pneumatic-tired rail bus for mail and passenger service.

Northern Pacific has ordered ten 4-8-4 type locomotives from Baldwin Locomotive Works.

RAILS

Delaware & Hudson has ordered 5000 tons of 131-lb. rails and 3000 tons of fastenings.

Louisville & Nashville has placed order for 17,500 tons of 100-lb. rails with Tennessee Coal, Iron & Railroad Co.

Richmond, Fredericksburg & Potomac has bought 500 tons of rails from Bethlehem Steel Co.

Delaware, Lackawanna & Western has purchased 11,000 tons of 131-lb. rails from Lackawanna Steel Co. and 1000 tons of 131-lb. rails from Carnegie Steel Co.

Pennsylvania has placed orders for about 51,000 tons of angle bars, tie plates and spikes.

Central of Georgia will purchase 3000 tons of rails and 900 tons of accessories.

Prices of Finished and Semi-Finished Steel, Coke, Coal, Cast Iron Pipe

BARS, PLATES, SHAPES

Iron and Steel Bars

	Soft Steel *Base per Lb.*
F.o.b. Pittsburgh mill	1.75c.
F.o.b. Chicago or Gary	1.85c.
Del'd Philadelphia	2.04c.
Del'd New York	2.08c.
F.o.b. Cleveland	1.80c.
F.o.b. Buffalo	1.85c.
F.o.b. Birmingham	1.90c.
F.o.b. cars dock Pacific ports	2.30c.
F.o.b. cars dock Gulf ports	2.15c.

Rail Steel
(For merchant trade)

F.o.b. Cleveland	1.70c.
F.o.b. Chicago	1.70c.
F.o.b. Gary	1.70c.
F.o.b. Pittsburgh	1.65c.
F.o.b. Buffalo	1.75c.
F.o.b. Birmingham	1.80c.

Billet Steel Reinforcing
(Stock lengths as quoted by distributers; cutting to length, 60 in. and over takes extra of 10c. per 100 lb.)

F.o.b. P'gh mills	1.80c.
F.o.b. Birmingham	1.85c.
F.o.b. Buffalo	1.85c.
F.o.b. Cleveland	1.85c.
F.o.b. Youngstown	1.85c.
F.o.b. cars dock Pacific ports	2.35c.
F.o.b. cars dock Gulf ports	2.20c.

(Cut lengths as quoted by distributers)

F.o.b. Chicago	1.95c.

Rail Steel Reinforcing
(Cut lengths as quoted by distributers)

F.o.b. Pittsburgh	1.75c.
F.o.b. Cleveland	1.80c.
F.o.b. Chicago	1.80c.

Iron

Common iron, f.o.b. Terre Haute, Ind.	1.60c. to 1.75c.
Refined iron, f.o.b. P'gh mills	2.75c.
Common iron, del'd Philadelphia	1.89c.
Common iron del'd New York	1.93c.

Steel Car Axles

F.o.b. Pittsburgh	2.50c.
F.o.b. Chicago	2.50c.

Tank Plates

	Base per Lb.
F.o.b. Pittsburgh mill	1.70c.
F.o.b. Chicago	1.75c.
F.o.b. Gary	1.75c.
F.o.b. Birmingham	1.85c.
Del'd Cleveland	1.885c.
Del'd Philadelphia	1.885c.
F.o.b. Coatesville	1.80c.
F.o.b. Sparrows Point	1.80c.
Del'd New York	1.98c.
F.o.b. dock cars Pacific ports	2.25c.
F.o.b. cars dock, Gulf ports	2.10c.
Wrought iron plates, f.o.b. P'gh	3.00c.

Floor Plates

F.o.b. Pittsburgh	3.20c.
F.o.b. Chicago	3.25c.

Structural Shapes

	Base per Lb.
F.o.b. Pittsburgh mill	1.70c.
F.o.b. Chicago	1.75c.
F.o.b. Birmingham	1.85c.
F.o.b. Buffalo	1.80c.
F.o.b. Bethlehem	1.80c.
Del'd Cleveland	1.885c.
Del'd Philadelphia	1.905c.
Del'd New York	1.8525c.
F.o.b. cars dock, Gulf ports	2.10c.
F.o.b. dock cars Pacific ports (standard)	2.25c.
F.o.b. dock cars Pacific ports (wide flange)	2.85c.

Steel Sheet Piling

	Base per Lb.
F.o.b. Pittsburgh	2.00c.
F.o.b. Chicago mill	2.10c.
F.o.b. Buffalo	2.10c.
F.o.b. cars dock Gulf ports	2.45c.
F.o.b. cars dock Pacific ports	2.45c.

Alloy Steel Bars

F.o.b. Pittsburgh, Chicago, Buffalo, Bethlehem, Massillon or Canton.

Open-hearth grade, base...2.45c. a lb. except at Bethlehem where the price is 2.55c.

S.A.E. Series Numbers	Alloy Differential per 100 lb.
2000 (1½% Nickel)	$0.25
2100 (2½% Nickel)	0.55
2300 (3½% Nickel)	1.50
2500 (5% Nickel)	2.25
3100 Nickel Chromium	0.55
3200 Nickel Chromium	1.35
3300 Nickel Chromium	3.80
3400 Nickel Chromium	3.20
4100 Chromium Molybdenum (0.15 to 0.25 Molybdenum)	0.50
4100 Chromium Molybdenum (0.25 to 0.40 Molybdenum)	0.70
4600 Nickel Molybdenum (0.20 to 0.30 Molybdenum) (1.50 to 2.00 Nickel)	1.05
5100 Chromium Steel (0.60 to 0.90 Chromium)	0.35
5100 Chromium Steel (0.80 to 1.10 Chromium)	0.45
5100 Chromium Spring Steel	base
6100 Chromium Vanadium Bar	1.20
4100 Chromium Vanadium Spring Steel	0.95
Chromium Nickel Vanadium	1.50
Carbon Vanadium	0.95

Above prices are for hot-rolled steel bars. The differential for most grades in electric furnace steel is 50c. higher. The differential for cold-drawn bars is ½c. per lb. higher with separate extras. Blooms, billets and slabs under 4x4 in. or equivalent are sold on the bar base. Slabs with a section area of 16 in. and 2½ in. thick or over take the billet base. Sections 4x4 in. to 10x10 in. or equivalent carry a gross ton price, which is the net price for bars fur the same analysis. Larger sizes carry extras.

Cold Finished Bars*

	Base per Lb.
Bars, f.o.b. Pittsburgh mill	2.10c.
Bars, f.o.b. Chicago	2.15c.
Bars, Cleveland	2.15c.
Bars, Buffalo	2.20c.
Bars, Detroit	2.30c.
Bars, eastern Michigan	2.35c.
Precision round bars, Pittsburgh	2.30c.
Precision round bars, Cleveland	2.35c.
Precision round bars (alloy), Pitts.	3.00c.
Shafting, ground, f.o.b. mill, 1⅛ in.	3.40c.
1-3/16 to 1½ in.	2.90c.
1-9/16 to 1⅞ in.	2.75c.
1-15/16 to 2⅜ in.	2.60c.
2-15/16 to 6 in.	2.45c.

* In quantities of 10,000 to 19,000 lb.

SHEETS, STRIP, TIN PLATE TERNE PLATE

Sheets

Hot Rolled

	Base per Lb.
No. 10, f.o.b. Pittsburgh	1.75c.
No. 10, f.o.b. Gary	1.85c.
No. 10, del'd Phila.	2.04c.
No. 10, f.o.b. Birmingham	1.90c.
No. 10, f.o.b. dock cars Pacific ports	2.42½c.

Hot-Rolled Annealed

No. 24, f.o.b. Pittsburgh	2.25c.
No. 24, f.o.b. Gary	2.35c.
No. 24, del'd Phila.	2.54c.
No. 24, f.o.b. Birmingham	2.40c.
No. 24, f.o.b. dock cars Pacific ports	2.95c.
No. 24, wrought iron, Pittsburgh	4.30c.

Heavy Cold-Rolled

No. 10 gage, f.o.b. Pittsburgh	2.30c.
No. 10 gage, f.o.b. Gary	2.40c.
No. 10 gage, del'd Phila.	2.59c.
No. 10 gage, f.o.b. dock cars Pacific ports	3.00c.

Light Cold-Rolled

No. 20 gage, f.o.b. Pittsburgh	2.75c.
No. 20 gage, f.o.b. Gary	2.85c.
No. 20 gage, del'd Phila.	3.04c.
No. 20 gage, f.o.b. dock cars Pacific ports	3.45c.

Galvanized Sheets

No. 24, f.o.b. Pittsburgh	2.85c.
No. 24, f.o.b. Gary	2.95c.
No. 24, del'd Phila.	3.14c.
No. 24, f.o.b. Birmingham	3.00c.
No. 24, f.o.b. dock cars Pacific ports	3.55c.
No. 24 Wrought iron, Pittsburgh	4.95c.

Long Ternes

No. 24, unassorted 8-lb. coating f.o.b. Pittsburgh	3.25c.

Vitreous Enameling Stock

No. 20, f.o.b. Pittsburgh	2.90c.

Tin Mill Black Plate

No. 28, f.o.b. Pittsburgh	2.65c.
No. 28, Gary	2.75c.

Tin Plate *Base per Box*

Standard cokes, f.o.b. P'gh district mill	$5.25
Standard cokes, f.o.b. Gary	5.35
Standard cokes, f.o.b. cars dock Pacific ports	5.90

Terne Plate
(F.o.b. Pittsburgh)
(Per Package, 20 x 28 in.)

8-lb. coating I.C.	$10.00
15-lb. coating I.C.	12.00
20-lb. coating I.C.	13.00
25-lb. coating I.C.	14.00
30-lb. coating I.C.	15.25
40-lb. coating I.C.	17.50

Hot-Rolled Hoops, Bands, Strips and Flats under ¼ In.

	Base per Lb.
All widths up to 24 in., P'gh	1.75c.
All widths up to 24 in., Chicago	1.85c.
Cooperage stock, Pittsburgh	1.85c.
Cooperage stock, Chicago	1.95c.

Cold-Rolled Strips

F.o.b. Pittsburgh	2.40c.
F.o.b. Cleveland	2.40c.
Del'd Chicago	2.68c.
F.o.b. Worcester	2.60c.

Fender Stock

No. 20, Pittsburgh or Cleveland	3.10c.

WIRE PRODUCTS

(Carload lots, f.o.b. Pittsburgh and Cleveland.)

To Manufacturing Trade

	Per Lb.
Bright wire	2.20c.
Spring wire	3.20c.

To Jobbing Trade

Extras of 10c. a 100 lb. on joint carloads and 30c. on pooled cars and less-than-carload lots are applied on all merchant wire products. An allowance of $2 a ton is made to jobbers on straight, mixed or joint carloads; $3 a ton is allowed on less-than-carload shipments.

	Base per Keg
Standard wire nails	$2.35
Smooth coated nails	2.35
Galvanized nails:	
15 gage and coarser	4.35
16 gage and finer	4.85
	Base per 100 Lb.
Smooth annealed wire	$2.35
Smooth galvanized wire	2.70
Polished staples	3.05
Galvanized staples	3.30
Barbed wire, galvanized	2.85
Woven wire fence, base column	60.00

Chicago and Anderson, Ind., mill prices are $1 a ton over Pittsburgh base (on all products except woven wire fence, for which the Chicago price is $2 above Pittsburgh); Duluth, Minn., and Worcester, Mass., mill prices are $3 a ton over Pittsburgh (except for woven wire fence at Duluth which is $5 over Pittsburgh), and Birmingham mill prices are $3 a ton over Pittsburgh.

STEEL AND WROUGHT PIPE AND TUBING

Welded Pipe

Base Discounts, f.o.b. Pittsburgh District and Lorain, Ohio, Mills

Butt Weld

Steel Inches	Black	Galv.	*Wrought Iron* Inches	Black	Galv.
⅛	51½	29½	⅛	+91½	+138
¼ to ⅜	57	38½	¼ & ⅜	+1½	+21½
½	62	50½	½	31½	15
¾	65½	55½	¾	36½	20½
1 to 3	67½	58½	1 & 1¼	39½	25½
			1½	43½	28
			2	41½	26

Lap Weld

2	63½	54½	2	37	22½
2½ to 3	66½	57½	2½ to 3½	38	25
3½ to 6	68½	59½	4 to 8	40	28½
7 and 8	67½	57½	9 to 12	38	24½
9 and 10	67	57			
11 and 12	66	56			

Butt Weld, extra strong, plain ends

⅛	48½	33½	⅛	+13	+45½
¼ to ⅜	54½	41½	¼ & ⅜	+2½	+34½
½	60	51	½	32½	17½
¾	64¼	55½	¾	37½	22½
1 to 3	66½	58½	1 to 2	43½	29

Lap Weld, extra strong, plain ends

2	61½	53½	2	40	26
2½ to 3	65½	57½	2½ to 4	45½	33
3½ to 6	69	61	4½ to 6	45	32½
7 and 8	68	58	7 & 8	46	33
9 and 10	67	57	9 to 12	41½	30
11 and 12	66	56			

Discounts on steel and wrought iron pipe are net and not subject to any points or preferentials.

Note—Chicago district mills have a base two points less than the above discounts. Chicago delivered base is 2½ points less. Freight is figured from Pittsburgh, Lorain, Ohio, and Chicago district mills, the billing being from the point producing the lowest price to destination.

Boiler Tubes

Base Discounts, f.o.b. Pittsburgh

Steel		*Charcoal Iron*	
2 in. and 2¼ in.	33	1½ in.—1¾ in.	44
2½ in.—2¾ in.	40	2 in.—2¼ in.	13
3 in.	44	2½ in.—2¾ in.	16
3¼ in.—3½ in.	47	3 in.	17
4 in.	49	3¼ in. to 3½ in.	18
4½ in. to 6 in.	42	4 in.	20
		4½ in.	21

On lots of a carload or more, the above base discounts are subject to a preferential of two fives on steel and of 10 per cent on charcoal iron tubes. Smaller quantities are subject to the following modifications from the base discounts:

Lap welded steel—Under 10,000 lb., 6 points under base and one five; 10,000 lb. to carload 4 points under base and two fives. Charcoal iron—Under 10,000 lb., 2 points under base; 10,000 lb. to carload, base and one five. Exception: On 1½ to 1¾-in. charcoal iron tubes no supplementary discounts are granted, and the discount for 10,000 lb. to a carload is 4 points under base and for less than 10,000 lb. 8 points under base.

Standard Commercial Seamless Boiler Tubes
Cold-Drawn

1 in.	68	3 in.	38
1¼ to 1½ in.	68	3¼ to 3½ in.	41
1¾ in.	68	4 in.	43
2 to 2¼ in.	27	4½, 5 and 6 in.	36
2½ to 2¾ in.	34		

Hot-Rolled

2 and 2¼ in.	33	3¼ to 3½ in.	47
2½ and 2¾ in.	40	4 in.	49
3 in.	44	4½, 5 and 6 in.	42

In the case of all sizes except 1-in. to 1¾-in. cold-drawn boiler tubes supplementary discounts of two 5 per cents are allowed on carload lots. On quantities up to 10,000 lb. the base discount is reduced 10 points and a supplementary discount of 5 per cent only is allowed. On quantities 10,000 lb. to 24,999 lb. the base discount is reduced 6 points and a supplementary discount of 5 per cent only is allowed. On 25,000 lb. to a carload the base discount is reduced 2 points and supplementary discounts of two 5 per cents are allowed.

On 1 to 1¾-in. cold-drawn boiler tubes, there are no supplementary discounts. On quantities up to 10,000 lb. the base discount is reduced 12 points; on 10,000 lb. to 24,999 lb., it is reduced 8 points; on 25,000 lb. to a carload it is reduced 2 points.

Seamless Mechanical Tubing

	Per Cent Off List
Carbon, 0.10% to 0.30% base (carloads)	55
Carbon, 0.30% to 40% base	50

Plus differential for lengths over 18 ft. and for commercial exact lengths. Warehouse discounts on small lots are less than the above.

RAILS AND TRACK SUPPLIES

F.o.b. Mill

Standard rails, 60-lb. and heavier, per gross ton	$36.37½
Angle bars, per 100 lb.	2.55

F.o.b. Code Basing Points

Light rails (from billets) per gross ton	$32.00
Light rails (from rail steel) per gross ton	31.00

	Base per 100 Lb.
Spikes, 9/16 in. and larger	$2.40
Spikes, ½ in. and smaller	2.40
Spikes, boat and barge	2.40
Tie plates, steel	1.90
Track bolts, to steam railroads	3.55
Track bolts, to jobbers, all sizes (per 100 count)	70 per cent off list

BOLTS, NUTS, RIVETS AND SET SCREWS

Bolts and Nuts

(F.o.b. Pittsburgh, Cleveland, Birmingham or Chicago)

	Per Cent Off List
Machine bolts	70
Carriage bolts	70
Lag bolts	70
Plow bolts, Nos. 1, 2, 3 and 7 heads	70
Hot-pressed nuts, blank or tapped, square	70
Hot-pressed nuts, blank or tapped, hexagons	70
C.p.c. and t. square or hex. nuts, blank or tapped	70
Semi-finished hexagon nuts	70
Semi-finished hexagon castellated nuts, S.A.E.	70
Stove bolts in packages, P'gh, 70, 25 and	10
Stove bolts in packages, Ch'go, 70, 25 and	10
Stove bolts in packages, Cleveland, 70, 25 and	10
Stove bolts in bulk, P'gh	83
Stove bolts in bulk, Chicago	83
Stove bolts in bulk, Cleveland	83
Tire bolts	60

Large Rivets
(½-in. and larger)

	Base per 100 Lb.
F.o.b. Pittsburgh or Cleveland	$2.75
F.o.b. Chicago and Birmingham	2.85

Small Rivets
(7/16-in. and smaller)

	Per Cent Off List
F.o.b. Pittsburgh	70 and 10
F.o.b. Cleveland	70 and 10
F.o.b. Chicago and Birm'g'm	70 and 10

Cap and Set Screws

(Freight allowed up to but not exceeding 65c. per 100 lb. on lots of 200 lb. or more)

	Per Cent Off List
Milled cap screw, 1 in. dia. and smaller	75, 10 and 10
Milled standard set screws, case hardened, 1 in. dia. and smaller	75 and 10
Milled headless set screws, cut thread ⅜ in. and smaller	75
Upset hex. head cap screw, U.S.S.S. or S.A.E. thread, 1 in. dia. and smaller	85
Upset set screws cut and oval point	75 and 10
Milled studs	65 and 5

STAINLESS STEEL

(Max. 16% Cr, 6% Ni, 0.15% C)
(Base Prices, f.o.b. Pittsburgh)

	Per Lb.
Bars	20½c.
Plates	24c.
No. 20 gage cold-rolled sheets	30c.
Hot-rolled strip	19½c.
Cold-rolled strip, 0.100 or over	25c.

SEMI-FINISHED STEEL

Billets, Blooms and Slabs

F.o.b. Pittsburgh, Youngstown, Chicago, Gary, Buffalo, Cleveland, Birmingham.

	Per Gross Ton
Rerolling	$26.00
Forging quality	31.00

Sheet Bars

F.o.b. Pittsburgh, Youngstown, Cleveland, Chicago, Buffalo, Canton, Sparrows Point.

	Per Gross Ton
Open-hearth or Bessemer	$26.00

Skelp

F.o.b. Pittsburgh, Youngstown, Chicago, Buffalo, Coatesville, Pa., or Sparrows Point, Md.

	Per Lb.
Grooved	1.60c.
Universal	1.60c.
Sheared	1.60c.

Wire Rods

(Common soft, base)

	Per Gross Ton
Pittsburgh	$36.00
Cleveland	36.00
Chicago	37.00
Birmingham	39.00
Youngstown (del'd)	37.00

ALLOY STEEL BLOOMS, BILLETS AND SLABS

F.o.b Pittsburgh, Chicago, Buffalo, Massillon, Canton or Bethlehem.

Base price, $49 a gross ton except at Bethlehem, where it is $51.

CARBON STEEL FORGING INGOTS

F.o.b. Pittsburgh, Youngstown or Chicago.

Uncropped, $38 per gross ton.

COKE, COAL AND FUEL OIL

Coke

	Per Net Ton
Furnace, f.o.b. Connellsville Prompt	$3.75
Foundry, f.o.b. Connellsville Prompt	$4.25 to 5.25
Foundry, by-product, Chicago ovens, for delivery outside switching district	8.50
Foundry, by-product, delivered in Chicago switching district	9.25
Foundry, by-product, New England, delivered	10.50
Foundry, by-product, Newark or Jersey City, del'd	8.20 to 8.81
Foundry, by-product, Phila.	9.00
Foundry, by-product, Cleveland delivered	9.27
Foundry, Birmingham	4.75
Foundry, by-product, St. Louis, f.o.b. ovens	8.00
Foundry, by-product, del'd St. Louis	9.00

Coal

	Per Net Ton
Mine run steam coal, f.o.b. W. Pa. mines	$1.55 to $1.80
Mine run coking coal f.o.b. W. Pa.	1.80 to 2.00
Gas coal, ¾-in., f.o.b. Pa. mines	2.00 to 2.30
Mine run gas coal, f.o.b. Pa. mines	1.80 to 2.20
Steam slack, f.o.b. W. Pa. mines	1.30 to 1.40
Gas slack, f.o.b. W. Pa. mines	1.65 to 1.85

Fuel Oil

Per Gal. f.o.b. Bayonne, N. J.

No. 3 distillate	4.00c.
No. 4 industrial	3.50c.

Per Gal f.o.b. Baltimore

No. 3 distillate	4.00c.
No. 4 industrial	3.50c.

Per Gal. del'd Chicago

No. 3 industrial fuel oil	3.73c.
No. 5 industrial fuel oil	3.23c.

Per Gal. f.o.b. Cleveland

No. 3 distillate	5.75c.
No. 4 industrial	5.50c.

REFRACTORIES

Fire Clay Brick

	Per 1000 f.o.b. Works: High-heat Duty Brick	Intermediate Duty Brick
Pennsylvania	$45.00	$40.00
Maryland	45.00	40.00
New Jersey	55.00	43.00
Ohio	45.00	40.00
Kentucky	45.00	40.00
Missouri	45.00	40.00
Illinois	45.00	40.00
Ground fire clay, per ton	7.00	

Chrome Brick

	Per Net Ton
Standard size	$45.00

Silica Brick

	Per 1000 f.o.b. Works
Pennsylvania	$45.00
Chicago	54.00
Birmingham	55.00
Silica clay, per ton	8.00

Magnesite Brick

	Per Net Ton
Standard sizes, burned, f.o.b. Baltimore and Chester, Pa.	$65.00
Unburned, f.o.b. Baltimore	55.00
Grain magnesite, f.o.b Baltimore and Chester, Pa.	40.00
Domestic, f.o.b. Chewelah, Wash.	22.00

CAST IRON PIPE

	Per Net Ton
6-in. and larger, del'd Chicago	$44.00 to $45.00
4-in., del'd Chicago	47.00 to 48.00
6-in. and larger, del'd New York	43.00
4-in., del'd New York	46.00
6-in., and larger, Birmingham,	36.00 to 37.00
4-in. Birmingham	39.00 to 40.00

Class "A" and gas pipe, $3 extra.

Pig Iron, Ores, Ferroalloys

PIG IRON

PRICES PER GROSS TON AT BASING POINTS

Basing Points	No. 2 Fdry.	Malleable	Basis	Bessemer
Everett, Mass.	$18.50	$19.00	$18.00	$19.50
Bethlehem, Pa.	18.50	19.00	18.00	19.50
Birdsboro, Pa.	18.50	19.00	18.00	19.50
Swedeland, Pa.	18.50	19.00	18.00	19.50
Sparrows Point, Md.	18.50	....	18.00	....
Neville Island, Pa.	18.00	18.00	17.50	18.50
Sharpsville, Pa.	17.50	17.50	17.00	18.00
Youngstown	17.50	17.50	17.00	18.00
Buffalo	17.50	18.00	16.50	18.50
Erie, Pa.	17.50	18.00	17.00	18.50
Cleveland	17.50	17.50	17.00	18.00
Toledo, Ohio	17.50	17.50	17.00	18.00
Detroit	17.50	17.50	17.00	18.00
Hamilton, Ohio	17.50	17.50	17.00	18.00
Chicago	17.50	17.50	17.00	18.00
Granite City, Ill.	17.50	18.00	17.00	....
Duluth, Minn.	18.00	18.00	....	18.50
Birmingham	13.50	....	12.50	....
Provo, Utah	16.50	....	....	....

DELIVERED PRICES PER GROSS TON AT CONSUMING CENTERS

	No. 2 Fdry.	Malleable	Basic	Bessemer
Boston Switching District				
From Everett, Mass.	$19.00	$19.50	$18.50	$20.00
From Buffalo	19.00	19.50	18.50	20.00
Brooklyn				
From East. Pa. or Buffalo	20.77	21.27	20.27	21.77
Newark or Jersey City, N. J.				
From East. Pa. or Buffalo	19.89	20.39	19.39	20.89
Philadelphia				
From Eastern Pa.	19.26	19.76	18.76	20.26
Cincinnati				
From Hamilton, Ohio	18.51	18.51	18.01	19.01
Canton, Ohio				
From Cleveland and Youngstown	18.76	18.76	....	....
Columbus, Ohio				
From Hamilton, Ohio	19.50	19.50	....	....
Mansfield, Ohio				
From Cleveland and Toledo	19.26	19.26	....	....
Indianapolis				
From Hamilton, Ohio	19.77	19.77	....	....
South Bend, Ind.				
From Chicago	19.55	19.55	....	....
Milwaukee				
From Chicago	18.50	18.50	....	....
St. Paul				
From Duluth	19.44	....	....	....
Davenport, Iowa				
From Chicago	19.26	19.26	....	....
Kansas City				
From Granite City	20.04	20.54	....	....

Delivered prices on Southern iron for shipment to Northern points are 38c. a gross ton below delivered prices from the nearest Northern basing points.

LOW PHOSPHORUS PIG IRON

Basing points: Birdsboro, Pa., Steelton, Pa. and Standish, N. Y.	$23.00
Johnson City, Tenn.	23.00
Del'd Chicago	28.65

GRAY FORGE PIG IRON

Valley furnace	$17.50

CHARCOAL PIG IRON

Lake Superior furnace	$20.50
Delivered Chicago	23.54
Delivered Buffalo	23.78

CANADA

Pig Iron

Per gross ton:

Delivered Toronto	
No. 1 fdy., sil. 2.25 to 2.75	$21.00
No. 2 fdy., sil. 1.75 to 2.75	20.50
Malleable	21.00
Delivered Montreal	
No. 1 fdy., sil. 2.25 to 2.75	$22.50
No. 2 fdy., sil 1.75 to 2.25	22.00
Malleable	22.50
Basic	22.00

Ferromanganese

	Per Gross Ton
Domestic, 80%, seaboard, (carload)	$82.00 to $85.00
Domestic, 80%, seaboard, (less carloads)	89.00 to 92.00

Spiegeleisen

	Per Gross Ton Furnace
Domestic, 19 to 21%	$24.00 to $27.00

Electric Ferrosilicon

	Per Gross Ton Delivered
50% (carloads)	$74.50 to $77.50
50% (ton lots)	82.00 to 85.00
75% (carloads)	120.00 to 126.00
75% (ton lots)	130.00 to 136.00
14% to 16% (f.o.b.) Welland, Ont. (in carloads) (duty paid)	31.00
14% to 16% (less carloads)	38.50

Silvery Iron

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		Per Gross Ton	
6%	$22.25	12%	$29.25
7%	23.25	13%	30.75
8%	24.25	14%	32.25
9%	25.25	15%	33.75
10%	26.25	16%	35.25
11%	27.75	17%	36.75

Bessemer Ferrosilicon

F.o.b. Jackson, Ohio, Furnace

Per Gross Ton		Per Gross Ton	
10%	$27.25	14%	$33.25
11%	28.75	15%	34.75
12%	30.25	16%	36.25
13%	31.75	17%	37.75

Manganese 1½ to 3%, $1 a ton additional. For each unit of manganese over 3%, $1 a ton additional. Phosphorus 0.75% or over, $1 a ton additional.

Other Ferroalloys

Ferrotungsten, per lb. wo. del., carloads	94c.
Ferrotungsten, less carloads	$1.00
Ferrochromium, 4 to 6% carbon and up, 65 to 70% Cr., per lb. contained Cr. delivered, in carloads	10.00c.
Ferrochromium, 2% carbon	16.50 to 17.00c.
Ferrochromium, 1% carbon	17.50c. to 18.00c.
Ferrochromium, 0.10% carbon	19.50c. to 20.00c.
Ferrochromium, 0.06% carbon	20.00c. to 20.50c.
Ferrovanadium, del., per lb. contained V.	$2.70 to $2.90
Ferrocarbontitanium, 15 to 18% per net ton, f.o.b. furnace in carloads	160.00
Ferrophosphorus, electric, or blast furnace material, in carloads, 18%, Rockdale, Tenn., base, per gross ton with $2 unitage	50.00
Ferrophosphorus, electric, 24% f.o.b. Anniston, Ala., per gross ton with $2.75 unitage	65.00
Ferromolybdenum, per lb. Mo., del.	95c.
Calcium molybdate, per lb. Mo., del.	80c.
Silico spiegel, per ton, f.o.b. furnace, car lots	$36.00
Ton lots or less, per ton	41.00
Silico-manganese, gross ton, delivered:	
2.50% carbon grade	85.00
2% carbon grade	90.00
1% carbon grade	100.00
Spot prices	$5 a ton higher

Ores

Lake Superior Ores, Delivered Lower Lake Ports

	Per Gross Ton
Old range, Bessemer, 51.5% iron	$4.80
Old range, non-Bessemer, 51.50% iron	4.65
Mesabi Bessemer, 51.50% iron	4.65
Mesabi, non-Bessemer, 51.50% iron	4.50
High phosphorous, 51.50% iron	4.40

Foreign Ore, c.i.f. Philadelphia or Baltimore

	Per Unit
Iron, low phos., copper free, 55 to 58% iron, dry Spanish or Algerian	9.50c.
Iron, low phos., Swedish, average 68½% iron	9.50c.
Iron, basic or foundry, Swedish, average, 65% iron	9c.
Iron, basic or foundry, Russian, aver. 65% iron (nom.)	9c.
Manganese, Caucasian, washed 52%	22c.
Manganese, African, Indian, 44-48%	20c.
Manganese, African, Indian, 49-51%	21c.
Manganese, Brazilian, 46 to 48½	17c.

	Per Net Ton Unit
Tungsten, Chinese wolframite, duty paid*	$12.00
Tungsten, domestic scheelite*	$11.00 to $12.00

	Per Gross Ton
Chrome, 45%, Cr_2O_3, crude, c.i.f. Atlantic Seaboard	16.00
Chrome, 48%, Cr_2O_3, c.i.f. Atlantic Seaboard	18.00

*Quotations nominal in absence of sales.

Fluorspar

	Per Net Ton
Domestic, washed gravel, 85-5 f.o.b. Kentucky and Illinois mines	$15.00
No. 2 lump, 85-5, f.o.b. Kentucky and Illinois mines	16.00
Foreign, 80% calcium fluoride, not over 5% silicon, c.i.f. Atlantic port, duty paid	18.50
Domestic, No. 1 ground bulk, 85 to 95% calcium fluoride, not over 2½% silicon, f.o.b. Illinois and Kentucky mines	30.00

Iron and Steel Scrap

PITTSBURGH

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$12.25 to $12.75
No. 2 heavy melting steel	10.25 to 10.75
No. 2 railroad wrought	12.25 to 12.75
Scrap rails	12.25 to 12.75
Rails 3 ft. and under	14.00 to 14.50
Sheet car crops, ordinary	13.00 to 13.50
Compressed sheet steel	11.75 to 12.25
Hand bundled sheet steel	10.25 to 10.75
Hvy. steel axle turnings	10.25 to 10.75
Machine shop turnings	8.25 to 8.75
Short shov. steel turnings	8.25 to 8.75
Short mixed borings and turnings	7.50 to 8.00
Cast iron borings	7.50 to 8.00
Cast iron carwheels	11.00 to 11.50
Heavy breakable cast	11.00 to 11.50
No. 1 cast	11.00 to 11.50
Railr. knuckles and couplers	14.00 to 14.50
Rail, coil and leaf springs	14.00 to 14.50
Rolled steel wheels	14.00 to 14.50
Low phos. billet crops	15.25 to 15.75
Low phos. sheet bar crops	14.50 to 15.00
Low phos. plate scrap	14.00 to 14.50
Low phos. punchings	14.50 to 15.00
Steel car axles	13.50 to 14.50

CHICAGO

Delivered Chicago district consumers:

	Per Gross Ton
Heavy melting steel	$9.50 to $10.00
Shoveling steel	9.50 to 10.00
Hydraulic comp. sheets	$8.50 to $8.50
Drop forge flashings	7.50 to 8.00
No. 1 busheling	8.00 to 8.50
Relled carwheels	11.00 to 11.50
Railroad tires	11.50 to 12.00
Railroad leaf springs	10.50 to 11.00
Axle turnings	8.00 to 8.50
Steel couplers and knuckles	10.50 to 11.00
Coil springs	11.50 to 12.00
Axle turnings (elec. fur.)	8.25 to 8.75
Low phos. punchings	11.50 to 12.00
Low phos. plates, 12 in. and under	11.50 to 12.00
Cast iron borings	6.00 to 6.50
Short shoveling turnings	6.00 to 6.50
Machine shop turnings	5.00 to 5.50
Rerolling rails	11.00 to 11.50
Steel rails, less than 3 ft.	11.00 to 11.50
Steel rails, less than 2 ft.	11.50 to 12.00
Angle bars, steel	10.50 to 11.00
Cast iron carwheels	10.00 to 10.50
Railroad malleable	10.50 to 11.00
Agricultural malleable	8.50 to 9.00

	Per Net Ton
Iron car axles	$11.50 to $12.00
Steel car axles	10.00 to 10.50
No. 1 railroad wrought	8.50 to 9.00
No. 2 railroad wrought	8.50 to 9.00

No. 2 busheling	$4.00 to	$4.50
Locomotive tires, smooth	9.00 to	9.50
Pipe and flues	5.25 to	5.75
No. 1 machinery cast	9.50 to	10.00
Clean automobile cast	9.00 to	9.50
No. 1 railroad cast	9.00 to	9.50
No. 1 agricultural cast	8.00 to	8.50
Stove plate	7.00 to	7.50
Grate bars	6.50 to	7.00
Brake shoes	8.50 to	9.00

PHILADELPHIA

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel		$11.00
No. 2 heavy melting steel	8.50 to	9.00
No. 1 railroad wrought		11.00
Bundled sheets	8.00 to	8.50
Hydraulic compressed, new	9.50 to	10.00
Hydraulic compressed, old	6.00 to	6.50
Machine shop turnings	7.00 to	7.50
Heavy axle turnings	9.50 to	10.00
Cast borings	5.50 to	6.00
Heavy breakable cast		11.00
Stove plate (steel works)		9.00
No. 1 low phos. heavy	13.00 to	14.00
Couplers and knuckles	12.00 to	12.50
Rolled steel wheels	12.00 to	12.50
No. 1 blast furnace	5.50 to	6.00
Spec. iron and steel pipe	9.00 to	9.50
Shafting	14.00 to	14.50
Steel axles	12.50 to	13.00
No. 1 forge fire		10.00
Cast iron car wheels	11.50 to	12.00
No. 1 cast	12.00 to	13.00
Cast borings (chem.)	12.00 to	14.00
Steel rails for rolling	11.00 to	11.50

CLEVELAND

Per gross ton delivered consumers' yards:

No. 1 heavy melting steel	$9.25 to	$9.50
No. 2 heavy melting steel	8.75 to	9.00
Compressed sheet steel	8.75 to	9.00
Light bundled sheet stampings	6.50 to	7.00
Drop forge flashings	9.00 to	9.50
Machine shop turnings	7.00 to	7.50
Short shoveling turnings	7.50 to	8.00
No. 1 busheling	9.00 to	9.50
Steel axle turnings	7.50 to	8.00
Low phos. billet crops	12.50 to	13.00
Cast iron borings	7.25 to	7.75
Mixed borings and short turnings	7.25 to	7.75
No. 2 busheling	7.25 to	7.75
No. 1 cast	10.50 to	11.00
Railroad grate bars	6.50 to	7.00
Stove plate	7.50 to	8.00
Rails under 3 ft.	14.00 to	14.50
Rails for rolling	10.50 to	11.00
Railroad malleable	11.75 to	12.00
Cast iron carwheels		11.00

BUFFALO

Per gross ton, f.o.b. Buffalo consumers' plants:

No. 1 heavy melting steel	$10.50 to	$11.00
No. 2 heavy melting scrap	9.50 to	10.00
Scrap rails	9.00 to	9.50
New hydraul. comp. sheets	9.50 to	10.00
Old hydraul. comp. sheets	6.50 to	7.00
Drop forge flashings	9.50 to	10.00
No. 1 busheling	9.50 to	10.00
Hvy. steel axle turnings	8.50 to	9.00
Machine shop turnings	7.00 to	7.50
Knuckles and couplers	12.00 to	12.50
Coil and leaf springs	12.00 to	12.50
Rolled steel wheels	12.00 to	12.50
Low phos. billet crops	13.50 to	14.00
Short shov. steel turnings	7.50 to	8.00
Short mixed borings and turnings	7.00 to	7.50
Cast iron borings	7.00 to	7.50
No. 2 busheling	6.50 to	7.00
Steel car axles	12.00 to	12.50
Iron axles	11.00 to	12.00
No. 1 machinery cast	12.00 to	12.50
No. 1 cupola cast	10.00 to	10.50
Stove plate	8.75 to	9.00
Steel rails, 3 ft. and under	11.50 to	12.00
Cast iron carwheels	11.00 to	11.50
Industrial malleable	11.50 to	12.00
Railroad malleable	11.50 to	12.00
Chemical borings	9.00 to	10.00

BIRMINGHAM

Per gross ton delivered consumers' yards:

Heavy melting steel		$10.00
Scrap steel rails		9.00
Short shoveling turnings		5.50
Stove plate	7.00 to	7.50
Steel axles	11.00 to	11.50
Iron axles	11.00 to	11.50
No. 1 railroad wrought		7.00
Rails for rolling		10.50
No. 1 cast	9.00 to	9.50
Tramcar wheels	9.00 to	9.50
Cast iron borings, chem.		8.00

ST. LOUIS

Per gross ton delivered consumers' yards:

Selected heavy steel	$9.50 to	$10.00
No. 1 heavy melting	8.50 to	9.00
No. 2 heavy melting	8.00 to	8.50
No. 1 locomotive tires	8.00 to	8.50
Misc. stand.-sec. rails	10.00 to	10.50
Railroad springs	10.25 to	10.75
Bundled sheets	6.00 to	6.50
No. 2 railroad wrought	8.25 to	8.75
No. 1 busheling	6.50 to	7.00
Cast iron borings and shoveling turnings	4.50 to	5.00
Rails for rolling	10.50 to	11.00
Machine shop turnings	4.25 to	4.75
Heavy turnings	5.50 to	6.00
Steel car axles	10.25 to	10.75
Iron car axles	12.50 to	13.00
Wrot. iron bars and trans.	9.25 to	9.75
No. 1 railroad wrought	6.25 to	6.75
Steel rails less than 3 ft.	12.00 to	12.50
Steel angle bars	11.50 to	12.00
Cast iron carwheels	8.00 to	8.50
No. 1 machinery cast	8.50 to	9.00
Railroad malleable	8.50 to	9.00
No. 1 railroad cast	8.00 to	8.50
Stove plate	6.50 to	7.00
Relay rails, 60 lb. and under	16.00 to	16.50
Relay, rails, 60 lb. and over	$20.00 to	$21.00
Agricult. malleable	9.00 to	9.50

BOSTON

Dealers' buying prices per gross ton:

No. 1 heavy melting steel	$5.50 to	$6.00
Scrap T rails	5.50 to	6.00
Machine shop turnings	2.00 to	2.50
Cast iron borings	4.00 to	4.25
Bundled skeleton, long	4.75 to	5.00
Forge flashings	4.75 to	5.00
Blast furnace scrap	4.75 to	5.00
Shafting	9.00 to	9.50
Steel car axles	8.50 to	9.00
Wrought pipe	3.50 to	4.00
Rails for rerolling	6.00 to	6.50
Cast iron borings, chemical	7.50 to	8.00

Per gross ton delivered consumers' yards:

Textile cast	$10.00 to	$10.50
No. 1 machinery cast	10.00 to	10.50
Stove plate	6.25 to	6.50
Railroad malleable	11.00 to	12.00

NEW YORK

Dealers' buying prices per gross ton:
Prices in italics for loading on barge; all others for loading on cars.

No. 1 heavy melting steel	$6.50 to	*$7.50*
No. 2 heavy melting steel	5.50 to	*6.50*
Heavy breakable cast	6.75 to	7.25
No. 1 machinery cast	6.75 to	7.50
No. 2 cast	5.50 to	6.00
Stove plate	5.00 to	5.50
Steel car axles	10.00 to	10.50
No. 1 railroad wrought	7.50 to	8.00
No. 1 yard wrought, long	$6.50 to	$7.00
Spec. iron and steel pipe	4.50 to	5.00
Forge fire	5.50 to	6.00
Rails for rerolling	8.00 to	8.50
Short shoveling turnings	3.00 to	3.50
Machine shop turnings	2.50 to	3.00
Cast borings	4.50 to	4.75
No. 1 blast furnace	2.50 to	3.00
Cast borings (chemical)	11.00 to	11.50
Unprepared yard iron and steel	2.50 to	3.00

Per gross ton, delivered local foundries:

No. 1 machinery cast		$9.50
No. 1 hvy. cast (cupola size)		7.75
No. 2 cast		7.00

CINCINNATI

Dealers' buying prices per gross ton:

Heavy melting steel	$8.25 to	$9.00
Scrap rails for melting	9.00 to	9.50
Loose sheet clippings	5.25 to	5.75
Bundled sheets	6.25 to	6.75
Cast iron borings	6.25 to	6.75
Machine shop turnings	5.75 to	6.25
No. 1 busheling	6.50 to	7.00
No. 2 busheling	3.50 to	4.00
Rails for rolling	9.50 to	10.00
No. 1 locomotive tires	9.00 to	9.50
Short rails	11.75 to	12.25
Cast iron carwheels	8.25 to	8.75
No. 1 machinery cast	9.50 to	10.00
No. 1 railroad cast	9.00 to	9.50
Burnt cast	6.50 to	7.00
Stove plate	6.50 to	7.00
Agricultural malleable	8.50 to	9.00
Railroad malleable	9.00 to	9.50

DETROIT

Dealers' buying prices per gross ton:

Heavy melting steel	$8.00 to	$8.50
Borings and short turnings	6.00 to	6.50
Long turnings	5.50 to	6.00
No. 1 machinery cast	8.00 to	8.50
Automotive cast	9.75 to	10.25
Hydraul. comp. sheets	8.00 to	8.50
Stove plate	6.00 to	6.50
New factory busheling	6.50 to	7.00
Old No. 2 busheling	5.00 to	5.50
Sheet clippings	5.50 to	6.00
Flashings	6.25 to	6.75
Low phos. plate scrap	8.50 to	9.00

CANADA

Dealers' buying prices per gross ton:

	Toronto	Montreal
Heavy melting steel	$5.50	$5.50
Rails, scrap	6.00	4.50
Machine shop turnings	2.50	2.50
Boiler plate	4.50	4.50
Heavy axle turnings	2.50	2.50
Cast borings	3.00	3.00
Steel borings	2.00	2.00
Wrought pipe	2.50	2.50
Steel axles	4.50	6.00
Axles, wrought iron	4.50	6.50
No. 1 machinery cast	7.75	9.00
Stove plate	4.50	5.00
Standard carwheels	7.25	7.00
Malleable	6.75	7.00

Warehouse Prices for Steel Products

PITTSBURGH

	Base per Lb.
Plates	3.05c.
Structural shapes	3.05c.
Soft steel bars and small shapes	2.85c.
Reinforcing steel bars	3.00c.
Cold-finished and screw stock—	
Rounds and hexagons	3.20c.
Squares and flats	3.20c.
Hoops and bands, under ¼ in.	3.10c.
Hot-rolled annealed sheets (No. 24), 25 or more bundles	3.15c.
Galv. sheets (No. 24), 25 or more bundles	3.70c.
Hot-rolled sheets (No. 10)	2.85c.
Galv. corrug. sheets (No. 28), per square (more than 3750 lb.)	$3.32
Spikes, large	2.90c.
Small	2.65c.
Boat	2.90c.
Track bolts, all sizes, per 100 count,	65 per cent off list.
Machine bolts, 100 count,	65 per cent off list.
Carriage bolts, 100 count,	65 per cent off list.
Nuts, all styles, 100 count,	65 per cent off list.
Large rivets, base per 100 lb.	$3.25
Wire, black, soft ann'l'd, base per 100 lb.	2.90
Wire, galv. soft, base per 100 lb.	3.35
Common wire nails, per keg	2.65
Cement coated nails, per keg	2.65

On plates, structurals, bars, reinforcing bars, bands, hoops and blue annealed sheets, base applied to orders of 400 to 9999 lb.

CHICAGO

	Base per Lb.
Plates and structural shapes	3.10c.
Soft steel bars	2.90c.
Cold-fin. steel bars and shafting	
Rounds and hexagons	3.25c.
Flats and squares	3.25c.
Bands, 3/16 in. (in Nos 10 and 12 gages)	3.20c.
Hoops (No. 14 gage and lighter)	3.20c.
Hot-rolled annealed sheets (No. 24)	3.70c.
Galv. sheets (No. 24)	4.30c.
Hot-rolled sheets (No. 10)	2.85c.
Spikes (9/16 in. and lighter)	3.50c.
Track bolts	4.65c.
Rivets, structural (keg lots)	3c.
Rivets, boiler (keg lots)	3.10c.
	Per Cent Off List
Machine bolts	60 and 5
Carriage bolts	60 and 5
Coach and lag screws	60 and 5
Hot-pressed nuts, sq., tap. or blank	60 and 5
Hot-pressed nuts, hex., tap. or blank	60 and 5
Hex. head and cap screws	85 and 10
Cup point set screws	75
Flat head bright wood screws	50 and 10
Spring cotters	60 and 10
Stove bolts in full packages	72½
Rd. hd. tank rivets, 7/16 in. and smaller	65
Wrought washers	$5.50 off list
No. 8 black ann'l'd wire per 100 lb.	$3.75
Com. wire nails, base per keg	2.70c.
Cement c't'd nails, base per keg	2.70c.

NEW YORK

	Base per Lb.
Plates	3.30c.
Structural shapes	3.27c.
Soft steel bars, small shapes	3.17c.
Iron bars	3.24c.
Iron bars, swed. charcoal	6.50c. to 7.00c.
Cold-fin. shafting and screw stock;	
Rounds and hexagons	3.92c.
Flats and squares	4.42c.
Cold-roll. strip, soft and quarter hard	4.00c.
Hoops	3.42c.
Bands	3.42c.
Hot-rolled sheets (No. 10)	3.17c.
Hot-rolled ann'l'd sheets (No. 24*)	3.65c.
Galvanized sheets (No. 24*)	4.25c.
Long terne sheets (No. 24)	4.75c.
Standard tool steel	12.00c.
Wire, black annealed (No. 10)	3.30c.
Wire, galv. annealed (No. 10)	4.05c.
Tire steel ⅛ x ⅓ in. and larger	3.40c.
Smooth finish, 1 to 2½ x ¼ in. and larger	3.75c.
Open hearth spring steel, bases	3.75c. to 10.00c.
Common wire nails, base, per keg	$3.00
	Per Cent
Machine bolt, cut thread:	Off List
¾ x 6 in. and smaller	60
1 x 30 in. and smaller	60
Carriage bolts, cut thread:	
½ x 6 in. and smaller	60
¾ x 20 in. and smaller	50
Boiler tubes:	Per 100 Ft
Lap welded, 2-in.	$18.05
Seamless welded, 2-in.	19.24
Charcoal iron, 2-in.	24.94
Charcoal iron, 4-in.	63.65

*No. 28 and lighter, 36 in. wide, 20c. higher per 100 lb.

ST. LOUIS

	Base per Lb.
Plates and struc. shapes	3.34c.
Bars, soft steel or iron	3.14c.
Cold-fin. rounds, shafting, screw stock	3.59c.
Hot-rolled annealed sheets (No. 24)	3.94c.
Galv. sheets (No. 24)	4.54c.
Hot-rolled sheets (No. 10)	3.19c.
Black corrug. sheets (No. 24)	3.99c.
Galv. corrug. sheets	4.59c.
Structural rivets	3.59c.
Boiler rivets	3.69c.
	Per Cent Off List
Tank rivets, 7/16 in. and smaller	60
Machine and carriage bolts, lag screws, fitting up bolts, bolt ends, plow bolts, hot-pressed nuts, square and hexagon, tapped or blank, semi-finished nuts	
1000 lb. or over	60
200 to 999 lb.	55 and 5
100 to 199 lb	50 and 5
Less than 100 lb.	50

PHILADELPHIA

	Base per Lb.
*Plates, ¼-in. and heavier	2.75c.
*Structural shapes	2.75c.
*Soft steel bars, small shapes, iron bars (except bands)	2.75c.
‡Reinforc. steel bars, sq., twisted and deformed	2.505c.
Cold-finished steel bars	3.58c.
*Steel hoops	3.30c.
*Steel bands, No. 12 to 3/16 in., incl.	3.05c.
Spring steel	5.00c.
†Hot-rolled annealed sheets (No. 24)	3.40c.
†Galvanized sheets (No. 24)	4.00c.
*Hot-rolled annealed sheets (No. 10)	2.95c.
Diam. pat. floor plates, ¼ in.	4.75c.
Swedish iron bars	6.25c.

These prices are subject to quantity differentials except on reinforcing and Swedish iron bars.

*Base prices subject to deduction on orders aggregating 4000 lb. or over.

†For 50 bundles or over.

‡For 5 tons or more, exclusive of cutting charge.

CLEVELAND

	Base per Lb.
Plates and struc. shapes	3.21c.
Soft steel bars	2.90c.
Reinforc. steel bars	2.00c. to 2.50c.
Cold-finished steel bars	3.25c.
Flat rolled steel under ¼ in.	3.26c.
Cold-finished strip	5.55c.
Hot-rolled annealed sheets (No. 24)	3.76c.
Galvanized sheets (No. 24)	4.36c.
Hot-rolled sheets (No. 10)	3.01c.
Black ann'l'd wire, per 100 lb.	$2.45
No. 9 galv. wire, per 100 lb.	2.80
Com. wire nails, base per keg	2.45

*Net base, including boxing and cutting to length.

CINCINNATI

	Base per Lb.
Plates and struc. shapes	3.30c.
Bars, soft steel or iron	3.10c.
New billet reinforc. bars	3.10c.
Rail steel reinforc. bars	3.10c.
Hoops and bands, 3/16 in. and lighter	3.35c.
Cold-finished bars	3.55c.
Hot-rolled annealed sheets (No. 24)	3.85c.
Galv. sheets (No. 24)	4.45c.
Hot-rolled sheets (No. 10)	3.10c.
Structural rivets	4.00c.
Small rivets	60 per cent off list
No. 9 ann'l'd wire, per 100 lb.	$3.00
Com. wire nails, base per keg (10 to 49 kegs)	2.65
Larger quantities	2.50
Cement c't'd nails, base 100-lb. keg	2.95
Chain, 1-in., per 100 lb.	8.35
	Net per 100 Ft
Seamless steel boiler tubes, 2-in.	$17.69
4-in.	41.23
Lap-welded steel boiler tubes, 2-in.	16.42
4-in.	38.31

BUFFALO

	Base per Lb.
Plates	3.27c.
Struc. shapes	3.15c.
Soft steel bars	2.95c.
Reinforcing bars	1.95c.
Cold-fin. flats and sq.	3.35c.
Rounds and hex.	3.25c.
Cold-rolled strip steel	5.25c.
Hot-rolled annealed sheets (No. 24)	4.00c.
Galv. sheets (No. 24)	4.15c.
Bands	3.32c.
Hoops	3.32c.
Hot-rolled unannealed sheets	3.07c.
Com. wire nails, base per keg	$3.00
Black wire, base per 100 lb.	3.25

BOSTON

	Per Lb
Beams, channels, angles, tees, zees	3.42c.
H beams and shapes	3.42c.
Plates—sheared, tank and univ. mill, ¼ in. thick and heavier	3.43c.
Floor plates, diamond pattern	5.18c.
Bar and bar shapes (mild steel)	3.25c.
Bands 3/16 in. thick and No. 12 ga. incl.	3.50c. to 4.50c.
Half rounds, half ovals, ovals and bevels	4.50c.
Tire steel	4.50c.
Cold-finished rounds and hexagons	3.70c.
Cold-rolled strip steel	5.20c.
Cold-finished squares and flats	4.20c.
Blue annealed sheets, No. 10 ga.	3.25c.
One pass cold-rolled sheets No. 24 ga.	3.50c.
Galvanized steel sheets, No. 24 ga.	4.60c.
Lead coated sheets, No. 24 ga.	5.65c.

Prices delivered by truck in metropolitan Boston, subject to quantity differentials.

PACIFIC COAST

	Base per Lb.		
	San Francisco	Los Angeles	Seattle
Plates, tank and U.M.	3.50c.	3.40c.	3.40c.
Shapes, standard	3.50c.	3.40c.	3.40c.
Wide-flanged beams and columns	3.70c.	3.60c.	3.60c.
Soft steel bars	3.55c.	3.40c.	3.40c.
Reinforcing bars	3.10c.	3.15c.	3.50c.
Hot-rolled annealed sheets (No. 24)	4.25c.	4.15c.	4.25c.
Hot-rolled sheets (No. 10)	3.75c.	3.65c.	3.65c.
Galv. sheets (No. 24)	4.85c.	4.75c.	4.85c.
Struc. rivets, ½ in. and larger	6.25c.	6.00c.	5.00c.
Cold finished steel			
Rounds	5.95c.	5.95c.	4.75c.
Squares and hexagons	7.20c.	7.20c.	6.00c.
Flats	7.70c.	7.70c.	7.00c.
Common wire nails —base per keg			
less carload	$3.05	$3.25	$3.45

All items subject to differentials for quantity.

Unprecedented Influx of Specifications Drives Up Operations in Valleys

YOUNGSTOWN, Dec. 26.—An unprecedented influx of specifications since the second week in December has necessitated sharply higher schedules in many steel operating departments in this district. Ingot output in the Valleys this week will likely be maintained at 38 to 40 per cent of capacity. A sharp reaction is expected immediately after Dec. 31, the final shipping date for fourth quarter contracts.

Although there is no denying the largely speculative character of December specifications, which covered chiefly carbon bars, wire products and plates, nevertheless a modicum of improvement in releases on sheet and strip steel also played a part in shaping the unusual course of steel operations at the year end. In cases where fourth quarter orders represented prices lower than those to become generally effective on Jan. 1, consumers specified very liberally. Despite the fact that a large share of the December tonnage will defer buying in January and possibly February, the spirit in business has engendered a buoyant sentiment in this district. The timely swelling of payrolls at the holiday season, moreover, has benefited thousands of steel workers.

First quarter volume will depend on resumption of large-scale demand from motor car makers, inauguration of equipment buying by the railroads, and continued releases of public works projects. Some railroad business already placed in this district will benefit producing schedules in next quarter. The Republic Steel Corpn. has received an order for about 13,000 tons of tie plates from the Pennsylvania Railroad. Another producer in this district has received orders from that carrier for track spikes and tie plates, the latter product to be furnished by its Chicago works.

Recent demand for oil country goods has been favorable, and routine drilling in many oil fields is expected to sustain interest in this class of tubular goods, at least for the next few months. A few line pipe projects are still pending, including a proposed natural gas line from Wyoming to Minnesota, and the piping of natural gas from the Mount Pleasant, Mich., producing fields to Saginaw, Bay City and Detroit. Crystallization of these projects, however, is not definitely assured. Construction of winter quarters for the Civilian Conservation Corps has stimulated a fair demand for stationary pipe.

The scrap market is pursuing an upward course as the year closes. No. 1 heavy melting steel, which had been purchased here in the fore part of December at $11.75, was sold in moderate quantities in the past week at $12.50. Dealer resistance to lower prices is stiffening, and the market for that grade is currently quotable at $12.50 to $13. Specialties are firm and in good demand. Blast furnace grades remain quiet. Ingot mold manufacturers have enjoyed a spurt in orders as a natural outcome of the lively open-hearth activities in recent weeks.

Practically all low-priced pig iron contracts will be cleaned up on Dec. 31. Some first quarter buying has appeared. With current pig iron prices applicable through first quarter, the recent forward contacting is considered an indication of definite consuming requirements for the coming period.

Institute Freight Tariff Book Ready

THE American Iron and Steel Institute is publishing a new freight tariff rate book covering so-called official territory, namely, east of the Mississippi River, north of the Ohio and Potomac rivers and including the New England States. The book shows all-rail rates on iron and steel products, both carload and less than carload, from the 34 principal basing points for products covered by the code to all the principal destinations in the territory above described. The new book will be available for distribution on or about Jan. 1, at $20.00 a copy, beyond the copy which is supplied to each member of the Code, with a charge of 10c. per sheet for revised or additional sheets.

▲▲ TRADE NOTES ▲▲

Ault & Wiborg Corpn., New York, has removed its Chicago offices to 1240 West Washington Boulevard. R. J. Hazucha is Chicago district manager.

Tubular Service Corpn., Brooklyn, is opening a Philadelphia office and warehouse, at 721-727 Sedgley Avenue, Philadelphia, on Jan. 1. Company distributes tubular goods for a number of mills, including Steel & Tubes, Inc., Boiler Tube Co. of America, and Pittsburgh Pipe Coil & Bending Co.

The Bristol Co., Waterbury, Conn., has incorporated the Bristol Co. of Canada, Ltd., with factory and general headquarters at 64 Princess Street, Toronto, Ont., where Bristol recording, indicating and control instruments will be made. J. S. Mayberry, for 10 years associated with the parent company, has been appointed manager.

Name Plates—L. F. Grammes & Sons, Allentown, Pa. Attractive brochure and folder illustrating etched, embossed and enameled plates, clock dials, lithographing on metal and embossed escutcheons in a variety of colors and finishes. Metal stampings and wire formings made by the company are also shown.

The American Gear Manufacturers Association has moved its headquarters from the First National Bank Building, Wilkinsburg, Pa., to the Penn-Lincoln Hotel, Wilkinsburg. This is also the headquarters of the code authority of the gear manufacturing industry.

PLANT EXPANSION AND EQUIPMENT BUYING

NEW ENGLAND

Board of Education, Greenwich, Conn., plans manual training department in addition to high school on Field Point Road. Cost $575,000. Financing will be arranged soon. Guilbert & Betelle, 20 Branford Place, Newark, N. J., are architects.

Boesch Mfg. Co., Danbury, Conn., has been organized by Arthur H. and Gustav S. Boesch, 45 River Street, to manufacture machinery and parts.

Town Council, Sterling, Mass., plans installation of pumping machinery and auxiliary equipment, pipe lines, etc., for municipal water system. Cost about $50,000. Financing is being arranged through Federal aid. Fay, Spofford & Thorndike, 44 School Street, Boston, are engineers.

Bristol Co., Waterbury, Conn., manufacturer of indicating and recording instruments, parts, etc., is establishing Canadian branch plant at 64 Princess Street, Toronto, to be operated by Bristol Co. of Canada, Ltd., a recently organized subsidiary.

School Department, Whitefield, N. H., plans manual training department in new two-story and basement high school. Cost about $115,000. Harold Holmes Owen, Inc., 6 North State Street, Concord, N. H., is architect.

Johnson & Sons, Inc., Norwich, Conn., has been organized by John O. Johnson, Jr., and Gardner B. MacGregory, 11 Warren Street, to manufacture sheet metal products.

State Military Department, Hartford, Conn., plans new one-story machine shop and equipment storage building at Stone Ranch State Reservation, East Lyme, Conn. Payne & Keefe, New London, Conn., are architects.

NORTH ATLANTIC

Marine Airport Corpn., affiliated with Pan-American Airways, Inc., 135 East Forty-second Street, New York, has taken option on 10 acre tract at Manor Haven, Manhasset Bay, L. I., and will use as new airplane base for proposed transatlantic airway lines. New hangars, shops for parts production and assembling, reconditioning and repairs, and other mechanical service will be built. Cost over $150,000 with equipment.

Farber & Shlevin, Inc., Brooklyn, has been organized by Nathan Farber, 279 Sullivan Place, and Clarence J. Shlevin, 612 Ocean Avenue, to manufacture metal products.

Wallerstein Co., Inc., 171 Madison Avenue, New York, manufacturer of industrial chemicals, etc., has let general contract to Wigton-Abbott Corpn., 143 Liberty Street, for one-story addition to plant at Mariners Harbor, S. I., and improvements in present factory. Cost about $40,000 with equipment.

Continental Can Co., 1 Pershing Square, New York, has let general contract to J. B. Townsend, Post-Dispatch Building, Houston, Tex., for one-story top addition to branch plant at Houston, 120 x 160 ft. Cost over $40,000 with equipment.

Board of Education, Huntington, L. I., plans manual training department in new multi-story high school. Cost about $550,000. Federal loan is being arranged. R. Burdick is school superintendent.

Warner Oil Burner Corpn., Brooklyn, has been organized by Joseph H. Warner, 6838 Dartmouth Street, Forest Hills, L. I., and associates, to manufacture oil burners and oil-burning equipment.

Allied Brewing & Distilling Co., 192 King Street, Brooklyn, has plans for additions, including shop unit. Cost over $50,000 with equipment. A. Jordan Bernstein, 1350 Broadway, New York, is engineer.

Zierick Mfg. Co., Bronx, New York, manufacturer of radio terminals and equipment, has leased space in building at Gerard Avenue and 144th Street for new plant.

Distillers & Brewers Corpn. of America, 21 West Street, New York, has arranged for new capital stock issue of $3,450,000, part of fund to be used for expansion, including new plants in different parts of country and extensions in present distilleries.

Mission Dry Corpn., 11 West Forty-second Street, New York, recently organized to build and operate distilling plant, storage and distributing plants in New York and other cities, is arranging for sale of stock totaling $3,309,587, part of fund to be used for purpose noted.

Sander Mfg. Co., Newark, N. J., has been organized by John W. and William G. Kautzman, Newark, capital $100,000, to manufacture meat-chopping and grinding machines, and kindred equipment. Company will take over organization of same name at 238 South Twentieth Street.

Passaic Valley Water Commission, 156 Ellison Street, Paterson, N. J., plans extensions in water supply in Wayne Township, utilizing additional water from Passaic River at Little Falls, N. J., including pumping stations, pipe lines and other distribution facilities. Cost about $1,000,000. Federal loan will be arranged.

Board of Education, Bayonne, N. J., plans manual training department in new three-story and basement high school at Avenue A and Twenty-ninth Street. Cost about $500,000. Financing will be arranged soon. Fanning & Shaw, 49 Ward Street, Paterson, N. J., are architects.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Jan. 3 for aircraft speed indicators (Schedule 1406), aircraft manifold pressure gages (Schedule 1369), engine cylinder indicators, switches, switch leads, thermocouple leads, etc. (Schedule 1397), aircraft fuel quantity gages (Schedule 1372), centrifugal aircraft tachometers (Schedule 1381), aircraft electric tachometers (Schedule 1398), aircraft turn and bank indicators (Schedule 1401) for Philadelphia Navy Yard.

Harrisburg Distilling Co., Harrisburg, Pa., recently organized, has taken over building at Derry and Swan Streets, Paxtang district, and will remodel for rectifying, storage and distributing plant. Cost over $25,000 with machinery.

Town Council, Chambersburg, Pa., plans extensions and improvements in municipal electric light and power plant, including installation of new 2500-kw. generator and auxiliary equipment. Fund of $105,000 has been arranged.

Acoustical Corpn. of America, 10 South Eighteenth Street, Philadelphia, manufacturer of sound equipment and devices, has purchased one-story factory at A and Venango Streets for new plant.

SOUTH CENTRAL

Mueller Co., Decatur, Ill., manufacturer of plumbing goods, brass specialties for water and gas service, etc., plans new one-story machine shop, 90 x 300 ft., at Columbian Iron Works, Chattanooga, Tenn., manufacturer of iron and other metal castings, etc., recently acquired. Additions also are planned for pattern shop, core room, storage and distributing units and other buildings. Work is scheduled for completion next spring. Cost about $180,000, of which over $100,000 will be expended for equipment.

J. E. Pepper Distillery Co., Lexington, Ky., has let general contract to Frank Messer & Sons Co., 2513 Burnet Avenue, Cincinnati, for initial buildings for new plant, including main two-story unit, 50 x 95 ft. Plans are being completed by Carl J. Kiefer, Schmidt Building, Cincinnati, consulting engineer, for stillhouse, bottling works, rectifying building, water-treating plant, power house and other buildings. Cost about $400,000 with equipment. Company is a subsidiary of Schenley Distillers Corpn., Schenley, Pa.

City Council, Selmer, Tenn., plans extensions and improvements in municipal water works, including new 75,000-gal. elevated steel tank and tower, deep-well pumping machinery and other equipment, pipe lines, etc. Fund of $92,000 has been arranged through Federal aid.

Common Council, Russellville, Ala., plans municipal electric transmission line and distributing system to utilize power from Federal hydroelectric power plant at Muscle Shoals, Ala. Financing for $65,000 is under way.

Old Lewis Hunter Distillery Co., Lexington, Ky., is arranging stock issue of $375,000, part of fund to be used for extensions and improvements.

WASHINGTON DISTRICT

American Zirconium Corpn., a subsidiary of Glidden Co., 13 North Liberty Street, Baltimore, manufacturer of paints, oils, varnishes, etc., with headquarters at Cleveland, has let general contract to Price Construction Co., Maryland Trust Building, Baltimore, for new plant in St. Helena industrial district, Baltimore, for manufacture of zirconium and kindred products. Initial works will consist of two one-story units, 116 x 245 ft., and 108 x 130 ft., respectively, with one-story power house, 35 x 54 ft. Cost over $350,000 with equipment.

Bureau of Yards and Docks, Navy Department, Washington, asks bids (no closing date stated) for electric-operated pumping machinery and accessories for Naval Academy, Annapolis, Md. (Specification 7573); until Jan. 17 for seaplane hangars at Coco Solo, Canal Zone (Specification 7531).

American Oil Co., American Building, Baltimore, has plans for new bulk oil storage and distributing plant at Winston-Salem, N. C. Cost over $35,000 with tanks and equipment.

Common Council, Galax, Va., plans new municipal electric light and power plant. Cost over $100,000 with power lines and system. Wiley & Wilson, Lynchburg, Va., are consulting engineers.

Bureau of Supplies and Accounts, Navy Department, Washington, asks bids until Jan. 3 for light and power cable (Schedule 1442) for Puget Sound Navy Yard; until Jan. 9, 5684 hacksaw frames for Eastern and Western yards (Schedule 1451), electric glue pots (Schedule 1452) for Brooklyn and Mare Island yards.

Roanoke Water Works Co., Roanoke, Va., operated by Virginia Water Co., plans new pumping plant, filter plant, pipe lines, etc., for water supply near Hollins, Va. Fund of about $1,000,000 is being arranged for project.

OHIO AND INDIANA

Crystal Springs Brewing Co., Cleveland, care of F. J. Hronek, 5208 Harvard Avenue, architect in charge, organized a few months ago, has rejected bids recently received for new plant, and will ask new bids soon on general contract. Plant will consist of main brew-house, bottling works, storage and distributing units. Cost about $175,000 with equipment.

Harper Aircraft Corpn., Elyria, Ohio, John Harper, head, has taken over former factory of Argo Aircraft Co., Alliance, Ohio, for production of light airplanes to sell at popular price, including parts production and assembling. Operations will begin in January.

Metal Specialty Co., 1533 Riverside Drive, Cincinnati, has leased one-story factory, 150 x 300 ft., at Este Place and Baltimore & Ohio Railroad, and will remodel and remove to new location in January and increase capacity.

Contracting Officer, Material Division, Wright Field, Dayton, Ohio, asks bids until Jan. 3 for 260 tail post lower support fittings and 130 tail post lugs (Circular 187), 1000 shut-off primer cock assemblies and 600 single engine primer assemblies (Circular 182); until Jan. 9, 30 electric etching machines (Circular 188).

Brownell Co., Dayton, Ohio, manufacturer of boilers, tanks, underfeed stokers, parts, etc., plans rebuilding part of one-story plant recently destroyed by fire. Loss about $100,000 with equipment.

Burkhardt Brewing Co., Akron, Ohio, is arranging for stock sale of $360,000, part of fund to be used for expansion.

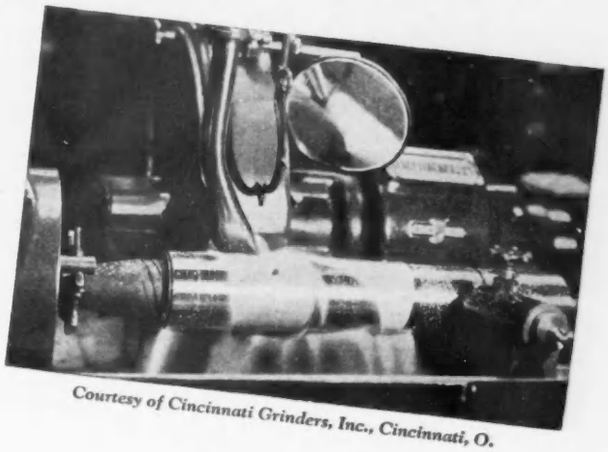
Common Council, Bradford, Ohio, plans new municipal electric light and power plant. Cost close to $100,000 with equipment. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

Indiana Breweries, Inc., Indianapolis, has arranged for increase in capital from $25,000 to $300,000, part of fund to be used for expansion. Leo McNamara is president.

Common Council, Fortville, Ind., plans new municipal electric light and power plant. Cost about $75,000 with equipment. Allen &

Courtesy of Cleveland Steel Products Corp., Cleveland, O.

OPERATION: MILLING THREAD ON 1 9/16 IN. SPLINE SHAFT, 20 THREADS
MACHINE: LEES-BRADNER THREAD MILLER.
MATERIAL: S. A. E. 3135 STEEL
CUTTER: 3 IN. R. P. M. 156.
PRODUCTION: 30 PIECES PER HOUR
LUBRICANT: 1 PART SUNOCO TO 15 PARTS WATER



Courtesy of Cincinnati Grinders, Inc., Cincinnati, O.

OPERATION: ROUGH AND SEMI-FINISH GRIND ON GRINDING WHEEL SPINDLE.
MACHINE: 14 IN. BY 48 IN. CINCINNATI PLAIN SELF-CONTAINED GRINDER.
MATERIAL: S. A. E. 3145 STEEL.
STOCK REMOVAL: .030 INCH.
LIMITS: PLUS, .0000 INCH. MINUS, .0002 INCH.
TIME PER PIECE: 35 MINUTES.
COOLANT: 1 PART SUNOCO TO 40 PARTS WATER.

AIDS IN REDUCING COSTS

Production held up—time lost in frequent changing and resharpening of tools—rejects excessive due to faulty finish and inaccurate tolerances, all because one factor—the cutting lubricant which is essential to the machining process, fails to live up to its promised performance.

Even in these days of emphasis on price, it is of greater importance that you have full confidence in the sustained quality of the cutting lubricant you purchase.

The ability to estimate the production capacities of cutter, drills, forming tools, etc., is an invaluable aid in computing manufacturing costs. The uniformity of Sunoco Emulsifying Cutting Oil will permit accurate predictions on the quantity of work your machine tools will produce.

Sunoco minimizes idle time by increasing the number of pieces produced between grinds.

When used on Abrasive Machine Tools, Sunoco will permit faster cutting, longer wheel life and consequent greater production.

Machine Tools operating with Sunoco give constant, uniform production with but little attention from the operator.

SUN OIL COMPANY, PHILADELPHIA, PA., U.S.A.

SUNOCO

EMULSIFYING

CUTTING OIL

Made by the producers of BLUE SUNOCO MOTOR FUEL

NRA MEMBER U.S. WE DO OUR PART

Akron, Albany, Allentown, Atlantic City, Baltimore, Battle Creek, Beaumont, Bridgeport, Buffalo, Chicago, Cincinnati, Cleveland, Columbus, Dallas, Dayton, Detroit, Flint, Grand Rapids, Harrisburg, Jackson (Mich.), Jacksonville, Miami, Newark, New York, Philadelphia, Pittsburgh Providence, Reading, Rochester, Scranton, Wilkes-Barre, Syracuse, Tampa, Toledo, Trenton, Washington, Wilmington, Youngstown.

Subsidiary Companies:

Sun Oil Co., Ltd., . . . Montreal and Toronto **British Sun Oil Co., Ltd., . . . London, England.**

Vagtborg, Inc., 205 West Wacker Drive, Chicago, are consulting engineers.

Richmond Brewing Co., Richmond, Ind., Philip Stapp, president, has let general contract to A. J. Glaser, Lincoln Avenue, for new one, two and four-story plant on 10-acre tract. Cost $700,000 with equipment. Vonnegut-Bohn & Mueller, Indiana Trust Building, Indianapolis, are architects and engineers. Same contractor has also been awarded one-story power house for brewery.

BUFFALO DISTRICT

International Harvester Co., Chicago, and 210 Teall Avenue, Syracuse, N. Y., manufacturer of farm and agricultural machinery and equipment, parts, etc., is considering new one-story plant at last-noted city on 3-acre tract, about 50,000 sq. ft. floor space. Cost over $85,000 with equipment.

Pleasant Valley Wine Co., Rheims, N. Y., Charles D. Chaplin, Hammondsport, N. Y., president, recently organized, is arranging for stock issue of $1,125,000, part of fund to be used for plant and equipment.

British Small Tool Manufacturers, Ltd., Toronto, Ont., recently organized to manufacture chisels, wrenches, pliers and kindred tools in carbon and chrome vanadium steels, has taken over factory of Robertson Tool Co., 260 Avenue Road, for plant.

Massay-Harris Co., Batavia, N. Y., manufacturer of farm machinery and equipment, parts, etc., has resumed operations at local plant, following shutdown for almost three years.

WESTERN PENNA.

Pennsylvania Refining Co., Titusville, Pa., will soon take bids for addition, including improvements in present oil refinery. Cost about $65,000 with equipment.

Schenley Distillers Corpn., Schenley, Pa., has acquired land adjoining plant of Old Quaker Distilling Co., Lawrenceburg, Ind., a subsidiary, and plans additions for bottling, blending and other service. Cost over $75,000 with equipment.

Borough Council, Wilkinsburg, Pa., is considering municipal incinerator plant. Cost about $100,000. A. Hutchinson, 608 South Avenue, is borough engineer.

SOUTH ATLANTIC

Old South Brewing Co., Winston-Salem, N. C., care of J. G. Isenhour, Winston-Salem, president, has leased mill at Statesville, N. C., and will remodel for new plant. Cost about $100,000 with equipment.

Town Council, Belle Glade, Fla., asks bids until Jan. 10 for pumping machinery and auxiliary equipment, 500,000-gal. capacity tank, pipe lines, etc., for municipal water system. William J. Lansley, Lake Worth, Fla., is consulting engineer.

Superintendent of Lighthouses, Key West, Fla., asks bids until Jan. 11 for metal work for nine iron structures for service at Miami Harbor, Miami, Fla.

City Council, Lexington, N. C., plans new steam-operated municipal electric light and power plant. Cost about $645,000 with equipment and power lines. Financing is being arranged through Federal aid, including an additional fund of $101,000 for extensions and improvements in municipal water system, with pumping machinery and other equipment.

City Council, Lake City, Fla., has arranged financing for $69,000 for extensions and improvements in municipal water system, including new deep-well pumping machinery, pipe lines and other equipment.

SOUTHWEST

Jack Daniel Distilling Co., 4024 Duncan Avenue, St. Louis, L. Motlow, president, recently organized, has arranged for increase in capital to $300,000. Company has taken over former plant of Ames Shovel & Tool Co., location noted, and will remodel for distillery. Cost about $85,000 with machinery.

Board of Education, Library Building, Kansas City, Mo., plans manual training department in new four-story and basement junior high school on Meyer Boulevard. Financing for $650,000 is being arranged. Charles A. Smith and Nate W. Downes, Finance Building, are architect and mechanical engineer respectively.

Common Council, Hayti, Mo., plans new municipal electric light and power plant. Application has been made for Federal loan of $131,500. W. A. Fuller Co., 2916 Shenandoah Avenue, St. Louis, is consulting engineer.

A. B. C. Brewing Corpn., 2825 South Broadway, St. Louis, has authorized extensions and improvements in former A. B. C. Brewery, including additional equipment. Cost over $50,000 with machinery. Richard S. Hawes, Jr., is president.

Common Council, Eufaula, Okla., has plans for municipal electric light and power station. Cost $122,000 with equipment. Federal loan is being arranged. H. C. Miller is engineer.

Supervising Engineer, United States Indian Irrigation Service, Federal Building, Albuquerque, N. M., asks bids until Jan. 4 for electric generators, exciters, electrical control equipment and accessories.

D. & T. Mfg. Co., St. Louis, has been organized by John M. Dougherty and B. A. Convy, capital $40,000, to manufacture heating systems and equipment. Company will take over organization of same name at 3001 La Salle Street.

Common Council, Osawatomie, Kan., plans municipal electric light and power plant, using Diesel engine-generator units, and municipal water system, with pumping machinery and accessories, pipe lines, etc. Cost $166,300. Application has been made for Federal loan. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

MICHIGAN DISTRICT

Detroit Aircraft Corpn., Detroit, has been organized by P. R. Beasley and associates, capital $200,000, to manufacture airplanes and parts. Company will take over and expand organization of same name at 607 Shelby Street.

Common Council, Mackinac Island, Mich., plans new municipal electric light and power plant, and waterworks station, with pumping machinery and auxiliary equipment. Cost about $150,000 with equipment.

Bates Ludington Co., Ludington, Mich., recently organized by Ralph E. Bates, Ludington, and associates, has taken over a local building and will soon begin production for line of automotive parts, including cylinder heads, intake and exhaust manifolds, clutches, transmission housings, etc.

MIDDLE WEST

Crown Cork & Seal Co., Inc., Eastern Avenue and Kresson Street, Baltimore, Md., manufacturer of metal bottle caps and seals, sealing machines, etc., has leased 40,000 sq. ft. in building at Kostner and Fifth Avenues, Chicago, for new factory branch, storage and distributing plant.

City Council, Alton, Ill., plans installation of pumping machinery and auxiliary equipment, pipe lines, etc., for new municipal water system. Cost $1,860,000. Financing will soon be arranged. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

Gee-Bee Mfg. Co., 900 West Van Buren Street, Chicago, has been organized by William J. Shafran, Maurice A. and Edward A. Ginsburg, to manufacture vending machines and parts.

Common Council, Litchfield, Minn., will take bids soon for equipment for municipal electric light and power plant, including new Diesel engine-generator unit and auxiliaries. Financing is being arranged. Charles Foster, Sellwood Building, Duluth, Minn., is consulting engineer.

City Council, Jamestown, N. D., has engaged Burlingame & Hitchcock, Sexton Building, Minneapolis, consulting engineers, to draw plans for new municipal electric light and power plant. Cost about $600,000 with equipment. Application is being made for Federal loan in that amount.

City Council, Oskaloosa, Iowa, is arranging for Federal loan of $460,190 for new municipal electric light and power plant. Burns & McDonnell Engineering Co., 107 West Linwood Boulevard, Kansas City, Mo., is consulting engineer.

Republic Flow Meter Co., 2240 Diversey Avenue, Chicago, manufacturer of indicating and recording instruments, steam flow meters, parts, etc., has let general contract to H. B. Barnard, 140 South Dearborn Street, for two-story addition, 48 x 75 ft. Dubin & Dubin, 127 North Dearborn Street, are architects.

Menomonee Falls Distilling Co., Inc., Menomonee Falls, Wis., new corporation, has acquired former beet sugar factory and will remodel into distillery, rectifying and bottling plant at cost of $180,000. Dieterich & Kraatz, Inc., 2717 West Lisbon Avenue, Milwaukee, are architects and engineers.

City Council, Milwaukee, has engaged Alvord, Burdick & Howson, 20 North Wacker Drive, Chicago, consulting engineers, to design and construct proposed $4,600,000 water filtration plant, for which Federal loan has been approved. Joseph P. Schwada is city engineer.

Metropolitan Sewerage District Commission, Madison, Wis., has commissioned Pearse, Greeley & Hansen, consulting engineers, 6 North Michigan Avenue, Chicago, to complete design of Nine Springs disposal plant, for construction of which Federal loan of $900,000 has been allotted. Herbert O. Lord is secretary.

G. Heileman Brewing Co., 1018 South Third Street, LaCrosse, Wis., has plans by Richard Griesser & Son, architects and engineers, 64 West Randolph Street, Chicago, for new brewhouse, 80 x 88 ft., four stories and basement, to cost $100,000 with equipment.

Plymouth Rock Distillery Co., Inc., Plymouth, Wis., has placed general contract with Gerhardt Albers, local builder, for new distilling plant, 40 x 200 ft., part two stories and basement; cost about $85,000 with equipment.

PACIFIC COAST

Standard Brands, Inc., 595 Madison Avenue, New York, and 245 Eleventh Street, San Francisco, manufacturer of yeast and kindred products, liquors, etc., has let general contract to Barrett & Hilp, 918 Harrison Street, San Francisco, for new plant at Elmhurst, Oakland, Cal. Cost about $500,000 with machinery. Bliss & Fairweather, Balboa Building, are architects; L. H. Nishkian, 252 Market Street, is engineer, both San Francisco.

Consolidated Aircraft Corpn., 2050 Elmwood Avenue, Buffalo, manufacturer of airplanes and parts, has plans for new works on 20-acre tract at Lindbergh Field, San Diego, with main one-story unit, 300 x 500 ft., one-story hangar, 100 x 120 ft., one-story storage and distributing plant, 100 x 100 ft., and two-story office building, 40 x 300 ft. Cost over $600,000 with equipment. Buffalo plant will be removed to new location, where production will be concentrated.

City Council, Lodi, Cal., has plans for new municipal hydroelectric power plant on Mokelumne River, with transmission line to city, substation and switching station, and distributing lines. Cost $580,000. Application has been made for Federal loan.

United Distilleries Corpn., Seattle, care of Maurice Hoard, Hoard Engineering Co., Pantages Building, plans new works on 12-acre tract near city, including main three-story distillery, 100 x 300 ft., one-story rectifying plant and gin distilling unit, 60 x 210 ft., and six-story storage and distributing plant. Cost over $200,000 with equipment. Carl J. Kiefer, Schmidt Building, Cincinnati, Ohio, is consulting engineer. R. N. Semmes, manager, East Waterway Dock Co., Seattle, is interested in new company.

Rainier Brewing Co., Seattle, has plans for extensions and improvements, including new equipment. New storage and distributing plant will be built. Cost over $350,000 with equipment.

E. Donald Marr, 21 Thirty-seventh Place, Long Beach, Cal., is at head of project to erect a new oil refinery near Long Beach. Cost about $175,000 with equipment, including bulk tank storage and distributing division.

International Television Corpn., Los Angeles, has been organized by Harry Finer and Dante LaFranche, Title Guarantee Building, capital $500,000, to manufacture radio and television equipment and parts.

FOREIGN

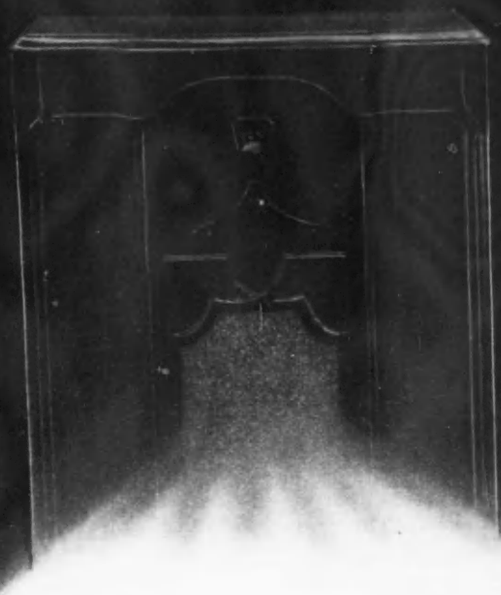
Ministry of Industry, State Government of Saxony, Dresden, Germany, plans new works near State-owned coal mines at Bohlen for production of gasoline from coal under special process. Plant will have initial capacity of about 20,000 metric tons (7,140,000 gal.) a year. Cost about 5,000,000 reichsmarks (about $1,975,000) with machinery.

Alliance & Dublin Consumers' Gas Co., Dublin, Ireland, has plans for a new benzol manufacturing plant, to utilize about 160,000 tons of coal a year as raw material. Cost over $500,000 with equipment.

BULLARD HYDRO-SHIFT

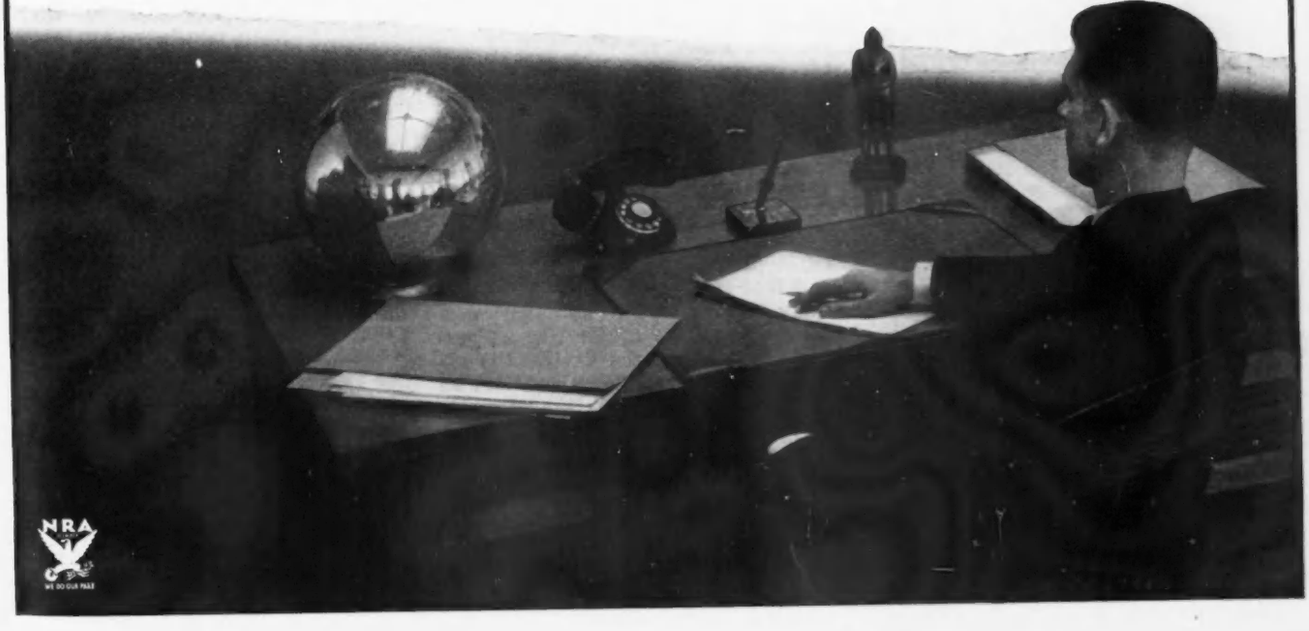
ANNOUNCING

VERTICAL TURRET LATHE



—and Looking Forward, Management realizes that shorter hours with increased payrolls present a New Problem of higher costs which must be paid for through Greater Operating Efficiency and Economy. The "Safe and Sure" move is replacement with Completely Modern Equipment. Therefore, study the New Equipment and know what it will do. With this in mind, Look to the Gazing Globe of Foresight in the next issue of THE IRON AGE, pages 8 and 9, where Management SEES a modern revelation:

Complete Efficiency by Motorization, Electrical and Mechanical Safety Devices, Four Heads with Independent Feed Works, Dial Reading and Control of Feed and Speed Settings, Hydraulic Shift of Speeds, Anti-friction Bearings, Automatic Lubrication of Slides and all Internal Bearings. Follow the Gazing Globe and see Bullard Hydro-Shift.



Creep and Fatigue Tests of 18 and 8 Steels

(*Concluded from Page* 25)

heat, cast or wrought, water-quenched or air-quenched, showed absolutely no reduction in impact resistance on test after being subjected to load at 1000 to 1200 deg. F. for periods of the order of 750 to 1750 hr. No certain explanation for this lack of impact embrittlement is at hand. Much of the high-carbon cast and wrought material came through creep tests of similar periods and temperatures without notable loss of impact resistance. It is possible to have wrought 18-8 of high-carbon content and without stabilizing elements that still has 85 to 105 ft.-lb. Izod after 1500 hr. under load at 1000 to 1100 or 1200 deg. F. The fracture of high-carbon cast bars at low elongation was not necessarily accompanied by low impact, some figures at 100 ft.-lb. being obtained on specimens from the unbroken portion of a fractured creep bar. The lowest individual impact figures on high-carbon specimens after creep test were 63 ft.-lb. for wrought and 45 for cast, but many impact figures were nearly as high as those for the materials before creep test.

Carbide precipitation occurred at elevated temperatures in both high and low carbon, and was no more marked in the high than in the low. Though internal changes occur, the creep curves show no irregularities to indicate coincident alteration in creep resistance. Creep curves for all four lots kept changing in slope during the earlier part of the creep tests, a fairly constant rate of creep not being approached till more than 500 hr., as a rough average, had elapsed. Many of the accelerated methods that have been suggested for determination of creep properties thus appear inapplicable to steels of this type.

Knudsen Sees Better Labor Relations Coming

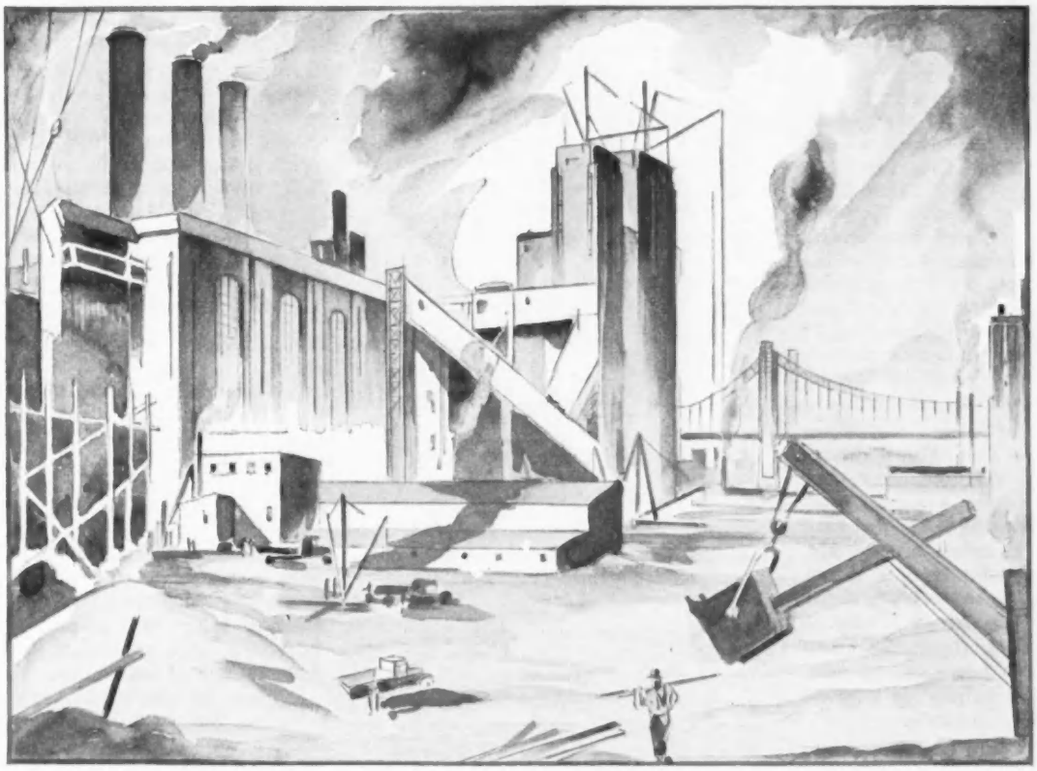
PLEDGING General Motors Corpn. to a policy of spreading work of a highly seasonal nature over as great a period of the year as possible and when this is not enough to meet the situation to place skilled men on other classes of work so as to give them a more adequate income, William S. Knudsen, executive vice-president in an address at Flint, Mich., recently, declared that the corporation intends to make its various plants and offices self-contained to the utmost. He stated that in a way Flint is the cradle of the corporation and that General Motors now proposes to "lay our shoulder to the wheel for the rehabilitation of Flint as the second motor city in Michigan."

Mr. Knudsen emphasized General Motors interest in stabilizing employment citywise saying the migration of workers from one city to another must be stopped within reasonable limits and that employment must be impartially distributed to as many permanent residents of the city as possible. Admitting the desirability of stabilizing automobile production, he pointed out obstacles in the path. He said that the best General Motors has been able to do is to estimate three months ahead and adjust these figures every 10 days against actual sales figures from the field. Mr. Knudsen put General Motors squarely behind the NRA with the declaration that the corporation "has signed a code, lived up to it and proposes to live up to it as long as it remains in force." He commented on the hysteria at first resulting from the act as follows: "The most was heard from two classes of expounders—those that claimed the act gave them part ownership in the company and those that claimed the company owned or tried to own the workers body and soul. As to the first, I know of no act which can eliminate property rights and manifestly the stockholders own the property and, to the second class, as far as I know slavery was abolished in the United States 65 years ago."

It is a healthy thing for American industry to have labor as a group think constructively from the standpoint of improving conditions, said Mr. Knudsen, who continued, "A few months ago there was a great deal of action on the part of industry and labor to remove some of the barriers that have grown up. The lack of sufficient order in this effort, however, threatened to disrupt the understanding between management and labor which this very action was designed to promote. In my opinion, we are now injecting the necessary order in this action and out of this I am confident will come a relationship between management and labor based on a mutual understanding of each other's problems in contrast to a policy of conflict of interest."

★ ★ ★ ★

UNCLE SAM . MASTER BUILDER



MORE than $3,000,000,000 of the $3,300,000,000 allotted by the Federal Government for public works has been allocated for federal, state, county and city projects in the form of loans and grants.

This money will be expended largely in the broad field of construction. Water systems with reservoirs, pipe lines and pumping stations; miles of highways, dams, sewage disposal facilities, public buildings of all descriptions — these and many others are, or soon will be, under way.

In New York, grants and loans have been made for the $44,200,000 Interborough Bridge and the $37,500,000 Midtown Vehicular Tunnel; on the lower Mississippi, $33,986,000 for levees and revetments; in Buffalo, $1,198,000 for schools; in Cleveland, $2,250,000 for water lines and $9,000,000 for a sewage disposal plant; in Kansas City, $1,135,000 for an auditorium; in Idaho, $4,000,000 for a dam on the Upper Snake River, and in Denver, $3,500,000 for a water works.

These are typical of the grants which have been made throughout the country.

Pig iron will be an important basic material in many of these projects.

For many years the plants of the Interlake Iron Corporation have supplied pig iron for a variety of products utilized in the construction industries.

INTERLAKE IRON CORPORATION

PIG IRON - COKE

PLANTS—CHICAGO . DULUTH . TOLEDO . ERIE

PICKANDS, MATHER & COMPANY, Sales Agents

CLEVELAND . CHICAGO . DETROIT . ERIE . TOLEDO . MINNEAPOLIS . DULUTH

Malleable Castings by the Duplex Method

(*Concluded from Page* 13)

chanical accessories could readily be made. Suffice it to say that a twin oven handling 25 tons of castings daily, as compared with six large individual 7-day ovens typical in the malleable plants today, should not much exceed one-third of the cost of these six ovens. Moreover, the net space taken in a building for these individual ovens is over three times greater than that required for the continuous oven. There are several good types of patented ovens on the market and in use. If these ovens permit the flexibility of shortened annealing cycles to a minimum of 24 hr. and if their cost is not exorbitant, these installations should be investigated and considered by all means.

In the matter of labor for this annealing process, a surprising economy is effected. For instance, one man should be able to get 2½ tons of castings from the cleaning room and load it properly for the annealing process. In addition, he should be able to unload 2½ tons at the other end of the oven, trucking the castings thence to a cooling area and finally to the cleaning room, all in a 2 hr. and 25 min. interval of time required for each of the two twin compartments.

Another man would be the nominal boss whose duties would be to supervise and render some assistance to the many referred to above; to watch the pyrometer, lift the sliding doors and move the castings in process for each 4¾ hr. intervals; to test the iron to detect underannealed castings. He would have plenty of time left for office conferences or in being generally useful with a broom or a shovel. Four 6-hr. shifts of two men each, working six days per week, would mean eight men for the 24-hr. day. Two additional men coordinating with this gang would man the annealing department 7 days a week and, with none of these 10 men working over 36 hr. per week, there would result for each ton of castings discharged from the oven a fraction over two man-hours per ton for annealing labor cost.

This discussion deals only with the melting, the molding and incidental foundry labor and the annealing aspects of malleable iron plant operation. There are many ways of turning out a better product from the other plant departments in a minimum of floor area and with a most sensible use of man power. It will be seen that with plant operation as outlined above, which is not in conflict with the Industrial Recovery program, a maximum wage scale and shorter hours for employees will still return a wide margin of profit to those whom may survive in the malleable iron industry. But the future of present day malleable iron plants depends upon taking some rather radical steps toward progress in order to function under the New Deal.

Oxy-Acetylene Flame for Hardening

(*Concluded from Page* 24)

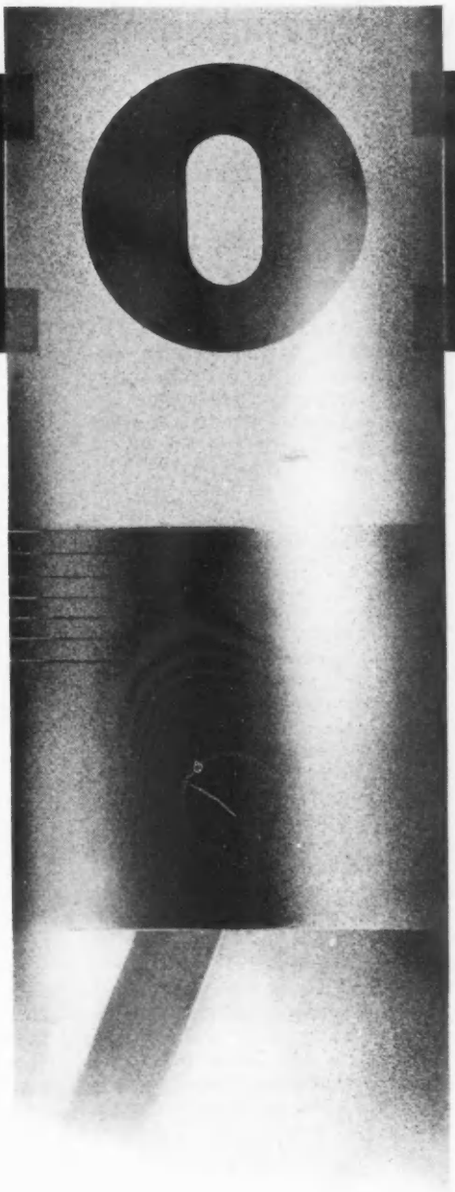
necessity for case carburizing, or has taken the place of complete heat treatment of a part by the usual furnace methods.

The substitution of steel fabrication for castings is often very advantageous from the point of view of reduction in weight or strengthening of the machine, and particularly to this society is of interest in that it leads to increased possibilities of fabrication by welding. The ability to harden locally such a structure enables one to put the part subject to wear in a very satisfactory condition to withstand the service it must meet, while at the same time the rest of the machine has the advantages of increased toughness and strength. Where case carburization is eliminated, we are substituting the oxy-acetylene hardening process, which can be carried out in seconds for one that required many hours of time and expensive equipment. Where the new method takes the place of the old standard heat treatment methods it has a distinct advantage due to its ability to be applied to a part of, instead of the whole of, the steel structure.

Metallurgical knowledge is required in order to apply the process correctly to the many grades of steel which are now met in the industrial field, each of which responds to heat treatment in its own peculiar way and considerable mechanical ingenuity is often necessary to adapt the method to production. However, knowledge of the kind necessary is available and, as is usual, it can be expected that as this technical method becomes more generally known, its use will grow at an ever-increasing rate.

A thorough study of industrial fatigue, monotony and industrial morale, in which careful account is taken of hours, working conditions, output, health and social background of workers in relation to output, is presented by Elton Mayo in "The Human Problems of an Industrial Civilization," published by the Macmillan Co. The work should be of intense interest to all employers inasmuch as effects and possible solutions are extended regarding the vicious results of modern industrial methods upon social organization and the social order. The contribution is particularly timely, and the thesis developed is that the broader effects of industrial development reveal themselves not primarily within the factory but rather in the destruction of the existing social order.

MOLY



GIVES GREY CAST IRON OUTSTANDING RESISTANCE TO ABRASION

MOLYBDENUM, long famous in the steel industry for making good steel better, is equally valuable to iron founders—producing results not readily duplicated by any other commercial alloy.

It adds a toughness to frictional parts that stubbornly defies wear. It increases tensile strength from 20 to 40% — transverse strength, 25 to 40% — fatigue strength, 25% — impact strength, 50 to 100% — and the Brinell hardness, 10-50 BHN. Yet, a Moly iron will machine *better* at the same Brinell hardness than an unalloyed iron. One foundryman has *doubled* the roughing machining speed on his lathe beds by the addition of 0.50% Molybdenum.

Let us show you how Moly, *at very low cost*, can improve the qualities of both cupola iron and the highest grade electric furnace iron. The modern Climax laboratories in Detroit are at your disposal for any test you care to make. Write for complete information about our free engineering and experimental services and ask for interesting book: "Molybdenum 1933." Climax Molybdenum Co., 295 Madison Avenue, New York City.

CLIMAX Mo-lyb-den-um

Collective Bargaining or Governmental Wage Fixing?

(*Concluded from Page* 20)

to re-establish operations by the employment of other workers. They have recognized that there was, in practically every case, a maximum wage which could not be exceeded without the employer preferring to submit to the permanent closing of his establishment—but below this point they have felt that they might properly demand and obtain any wage which they deemed reasonable. Furthermore, they have vigorously contested the right of the public to intervene by compulsory arbitration or other judicial or semi-judicial process. Their contention has been, in effect and by open avowal, that a solidly established labor monopoly in each trade or industry should bargain with the similarly organized employers, and that the resulting bargains should be free from interference by consumers or the public as a whole.

Why Employers Oppose Unionization

It would be idle to attempt to assess blame for labor union excesses, or to weigh them in the balance against the opposing equally undesirable practices of certain captains of industry and finance. The essential point is that the closed-shop plan of the national unions has represented, in practice, a program to which most employers have felt unwilling or unable to subscribe.

Individual employers might believe in the theoretical possibilities of collective bargaining, and of established relations with the national unions. They might be impressed by evidence of the success of the latter relations in specific cases. But, as men faced with immediate responsibilities for the industries under their direction, they could not disregard the obvious practical dangers of the situation. They have, therefore, felt compelled to set themselves in opposition to the national unions—and, in doing so, their most effective weapon has been the establishment of working conditions and of understandings with employees of such nature as, in many cases, to remove very completely any desire on the part of their workers for membership in the national unions.

On the whole, prior to the present depression, and in fact up to the date of passage of the National Recovery Act, the tide seemed to be setting strongly against the national unions. Their memberships were decreasing, and in large measure they were abandoning hope of any ultimate widespread success for their closed-shop program. Also, as the direct result of this situation, they were being forced seriously to contemplate that entry into the political field which hitherto they had so studiously avoided.

Public Rights in Labor Disputes

For the moment, under the provisions of the present emergency legislation, the situation is too confused to make it possible to venture any definite forecast as to the outcome. On the surface, collective bargaining appears to have gained ground, and the national labor unions also appear to have prospects for added strength of position.

But, on the other hand, the protests of farmers and other consumers, and the necessity which rests upon the administration of preventing industry and commerce from being so loaded with new burdens as to check the processes of recovery, would seem to suggest that the more probable outcome may be an extensive and initially confused series of determinations of wages and working conditions by Federal agencies, in which the activities of the labor unions and the processes of collective bargaining will be very completely subordinated to a semi-judicial procedure under public control. In the end, even though the process may be a slow and painful one, it is not an unreasonable hope that the verities will emerge.

Let us assume, at least, that our civilization has not already fallen as Rome apparently fell, without the moment of its fall being perceived. Let us hope that at not too distant a date we shall see a return of substantially full employment and business activity. And let us then attempt to establish some of the essentials and practical possibilities for a future more orderly working out of those problems which concern themselves with wages and working conditions.

Perhaps the first consideration of all will be the absolute necessity for a national program which will assure a reasonable and general freedom from such extremities of depression and unemployment as we have recently witnessed. Fortunately, there is a growing realization of the possibilities which lie in a reasonable stabilization of the production of capital goods, and it is not too much to hope that some approximation to an effective program for employment stabilization will emerge from the present crisis.

A second major consideration will be the right of consumers and of the public as a whole to intervene in labor disputes and, in particular, to prevent the consummation of any agreements which may tend unduly to raise prices of goods and costs of services. Progress in this respect will necessarily be slow. From the standpoint of the workers, the prime purpose of collective bargaining is, with rare exceptions, to obtain *more* than a market wage—nevertheless, the trend of any system of judicial wage determinations by public authority must inevitably be toward using the market wage as the only possible test of reasonableness and to leave to industrial controls and regulation the problem of protecting consumers and wage-earners against payment of prices which may be in excess of those justified by wage and other costs and by reasonable profit margins.

Governmental Wage Fixing

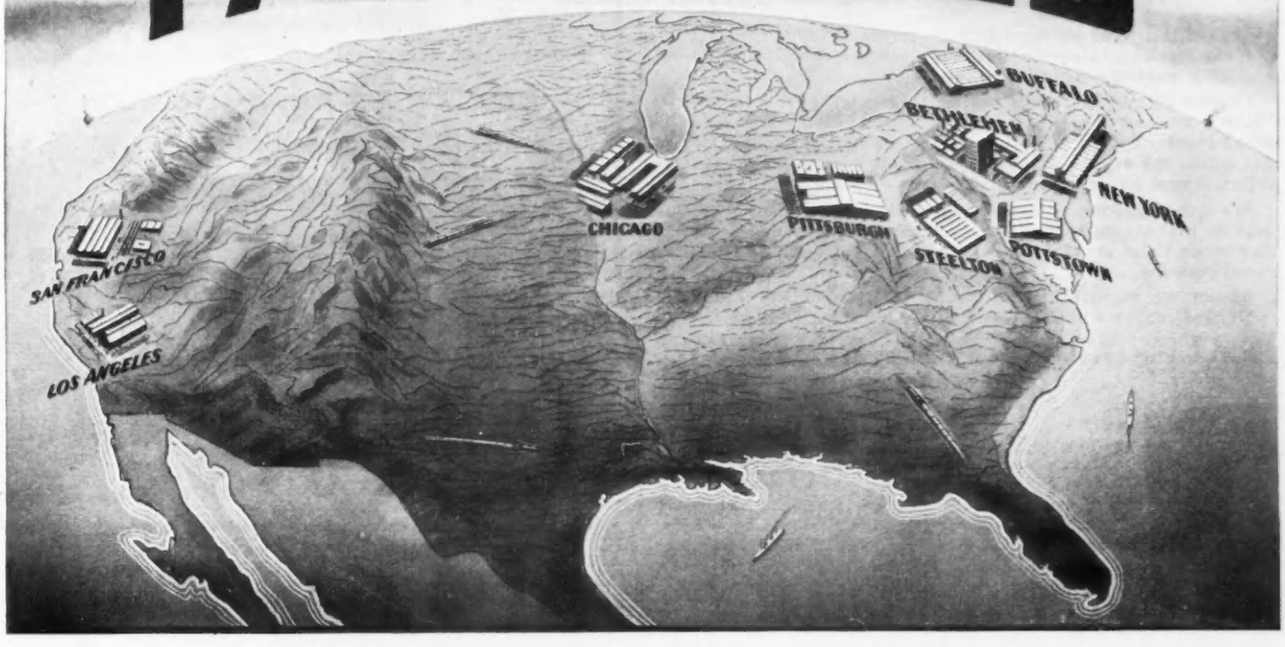
As to this special and dominating feature of the whole problem, the present emergency may make its important contributions. The general belief in the existence of excessive profit margins will be slow to disappear, but, by painful trial and error, the processes of Governmental wage and price fixing should go far to establish the true facts in the public consciousness. The efforts to arrive at price and currency stabilization will also tend to develop the absolute incompatibility between such stabilization and any program which permits the arbitrary fixing of wages at rates varying substantially from those market levels which at any given time must naturally and normally be related to a stabilized level of general prices.

To whatever extent we may move in the near future with respect to the substitution of a judicial procedure for unregulated industrial strife, it seems clear, furthermore, that the trend will be increasingly toward a recognition of the paramount interest of consumers, and of the public as a whole, in wage disputes and determinations. The result should very certainly be a decrease in the importance of collective bargaining as the background for labor union activities and an accentuation of the recent trend of the national unions toward political action.

"Industrial Uses of Stainless Steel" was the title of a talk delivered before a meeting of the American Society of Mechanical Engineers at Cincinnati, Nov. 23, by C. C. Snyder, of the Central-Alloy Division, Republic Steel Corp., Massillon, Ohio. Prefacing his address with a brief history of the development of stainless steel, Mr. Snyder then divided the present large number of different types of stainless steel into the proper main groups, giving their general characteristics and properties.

The latter part of the talk stressed the rapidly increasing use of stainless steel in various industries, such as building, meat packing, brewing, automotive and the chemical and allied industries.

FACILITIES



FROM COAST TO COAST

WHEN buying structural steel or steel plate-work, of first importance is the reputation of the manufacturer. Of next importance are his facilities—the rapidity of his fabrication—the skill of his workmen.

During the past 34 years McClintic-Marshall has established an enviable reputation for high quality fabrication and erection. McClintic-Marshall's wide facilities, from coast to coast, offer buyers of steel structural work the opportunity of having their orders completed by a plant close to their job. Large plants at Pottstown, Steelton and Bethlehem, Pa., at Buffalo, N. Y., and in the Pittsburgh and Chicago areas, and at Los Angeles and San Francisco, are always prepared to meet immediately your steel requirements.

The variety of projects for which McClintic-Marshall constantly furnishes steel has given them a wide fabricating experience. Any of McClintic-Marshall's plants is thoroughly qualified, by reason of modern machinery and trained personnel, to handle your steel requirements promptly and efficiently, and McClintic-Marshall's erection crews with complete equipment are always ready for immediate service.

No matter what your project may be, or where, you will find McClintic-Marshall's facilities adequate for your steel requirements.

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BETHLEHEM STEEL

McClintic-Marshall Steel Construction

JUST BETWEEN US TWO

Goodbye, Forever

WITH this issue we bid adieu to the year of blue eagles, bank closings and baloney dollars—a good time to lick our wounds and gloat over our victories, if any.

Of course, the Spartanlike thing to say of the depression is: "Never touched me!" even though one be bloody, dazed and punchdrunk. But, if anything, we are honest. We admit we did not escape the depression unsinged. Though our vital organs are intact, a neat bit of fat was burned off our waistline.

We recall mournfully the days when our advertising embonpoint was so pronounced that you could open a copy of The Iron Age five or six times at random without once happening upon the editorial contents.

Maybe we ought to feel better with a perpendicular stomach wall, and maybe we look better after our enforced diet, but we have a weakness for convex curves, and the sooner we have to let out that lap in our trousers the happier we'll be.

The Worm Turns

THE turning point came in May. Advertising volume began to pick up then, and the climb uphill, while hardly precipitous, is at least steady. The same with circulation. December figures are not yet in, but in the seven months from May to November new subscriptions totaled 1,853, which was 72 per cent better than the 1,071 of the corresponding months of 1932.

But the happiest omen of all is subscription renewals. In May, June and July, 1932, 68.5 of every 100 expirations were renewed. In the same months of 1933, 78.8 of every 100 were renewed, and the returns are not yet all in, as the A.B.C. allows us six months in which to get renewals.

We aren't bragging—not much anyway. Wild horses could not have dragged these confidential figures out of us (we hope you will keep them to yourself, as we would hate to have them bandied about) did we not feel it our duty to reveal that the terrific mortality rate in industry has slowed down to a mild canter.

A guess might be hazarded that high editorial quality has something to do with it, but why drag in the obvious?

Also, we feel pretty good about 1934.

Hi, There, Duce!

MUSSOLINI has served notice on all Italian periodicals that whenever his name appears in type it must be in full capitals, thus, "MUSSOLINI." If we were Latin we would lie awake nights worrying lest the printer mistake our sprawling "f.c." for "l.c." and set it "mussolini." *Imagine trying to explain an innocent error to Il Duce. Them eyes! Those chin!*

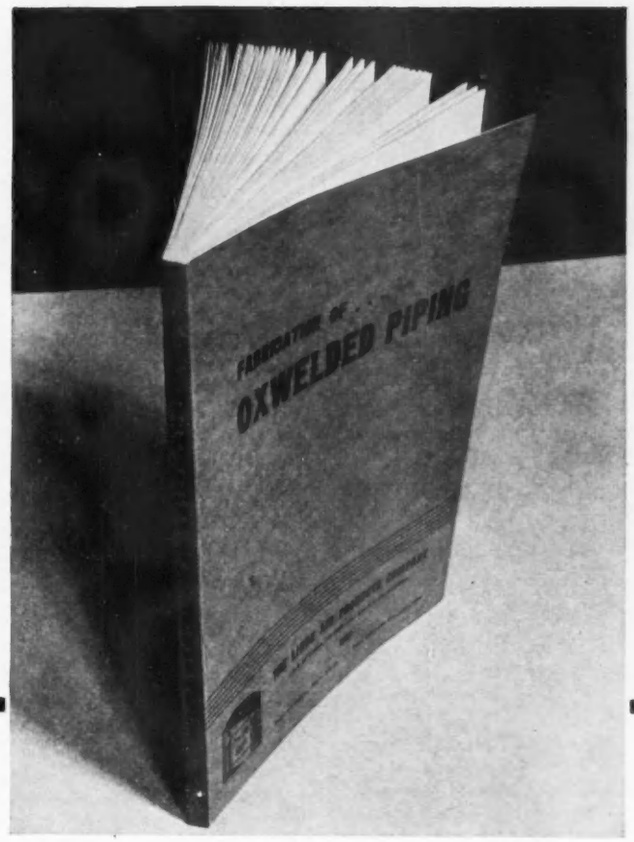
Up With the Right Hand

WE are kind of fed up on the expression, "As Al Smith says, look at the record." Like Al Smith himself, it has been overworked, and we hope that in deference to our feelings everyone will resolve to forego its use in 1934 and later.

We Shivered Unnecessarily

WHY is it the words, "Well, to be frank with you . . .," are usually followed by something disagreeable? We were all set for a dirty crack when the word "frank" was used in a letter we received from Wolf, Netter & Jacobi-Werke, machinery builders in Berlin-Adlershof, Germany, when what should pop out but a fragrant bouquet:

> "In view of business conditions, we thought we could get along without THE IRON AGE in addition to other papers. We are frank enough, however, to admit that *we have now discovered that we cannot do without your paper.* We therefore wish to order it again."
>
> — — —
>
> ***May 1934 be a year of unprecedented happiness and prosperity for you and yours.*** ***—A.H.D.***



THIS NEW BOOK-

covers all phases of Oxwelded Piping

HERE is the only complete presentation of the fundamentals of pipe welding technique ever published. This new 160 page book, "Fabrication of Oxwelded Piping" answers every question on the installation, fabrication and erection of oxwelded piping systems. It contains complete data and procedures for using recently developed welding methods, new material on welding fittings and the welding of joints in steel, cast iron and non-ferrous piping.

Engineers, inspectors, superintendents, foremen, pipe fitters and welders will find this book a mine of general and specialized information. From the standpoint of management charged with making capital expenditures, it points the way to lowered welding costs through its presentation of detailed procedures on Lindewelding. The growing use of this new method in the field of industrial and building piping makes it imperative that up-to-date builders, contractors, architects and engineers study this technique, presented for the first time in the "Fabrication of Oxwelded Piping."

We will gladly send you "Fabrication of Oxwelded Piping" free of charge, if you can use it to advantage. It is offered only to those who write for it. Address your request to the nearest Linde District Office.

LIVE TOPICS DISCUSSED IN THIS BOOK

—fundamentals of pipe welding technique. The clear, concise presentation will enable an operator to learn pipe welding more readily and equip him to handle any unusual welding problem.

—procedures on Lindewelding, covering the application of this technique to all classes of piping.

—time and material data with tables for estimating costs provide essential information for use as a basis for computing costs.

—layout and fabrication of oxwelded piping, establishing reference lines, laying out cuts with or without the use of templets, header fabrication etc.

—special recommendations on joint design and the latest practices in oxwelding cast iron, copper, brass and lead pipe.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

126 Producing Plants UCC 627 Warehouse Stocks

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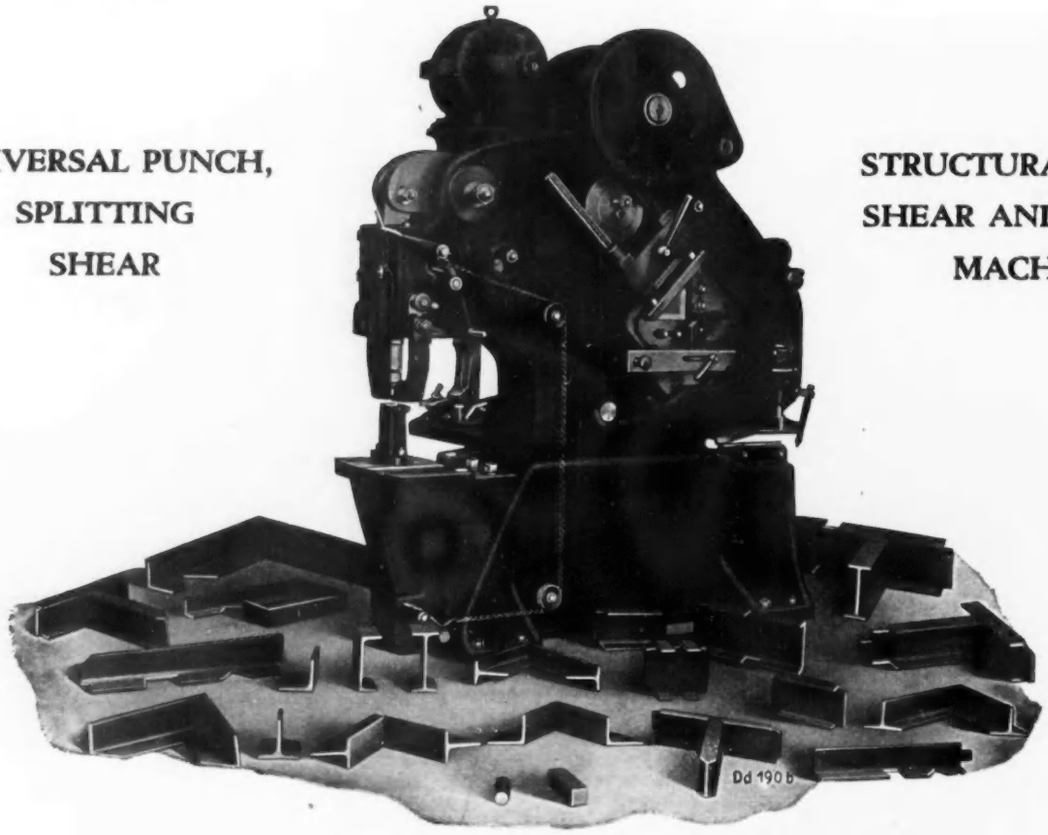
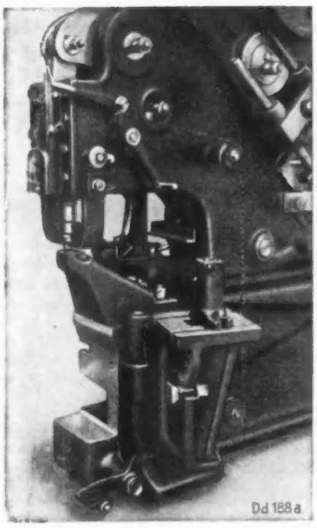
Buffalo	El Paso		Pittsburgh	Tulsa

UNIVERSAL PUNCH, SPLITTING SHEAR



STRUCTURAL STEEL SHEAR AND COPING MACHINE

SCHATZ



Many new and exclusive and patented features increase the usefulness of this machine and decrease costs.

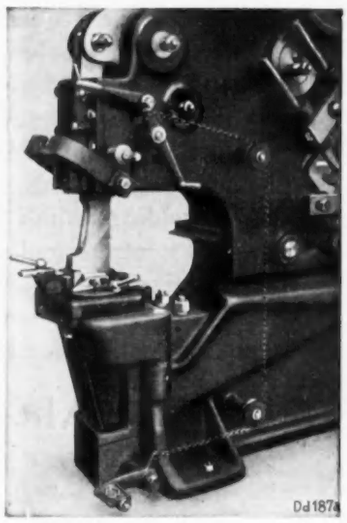
Steel frame guaranteed unbreakable.

Punches holes, cuts angles and tees on square or miter; cuts rounds, squares, flats, beams and channels; copes or notches; splits plate any width or length.

Appreciated by those who want to do accurate work quickly and economically.

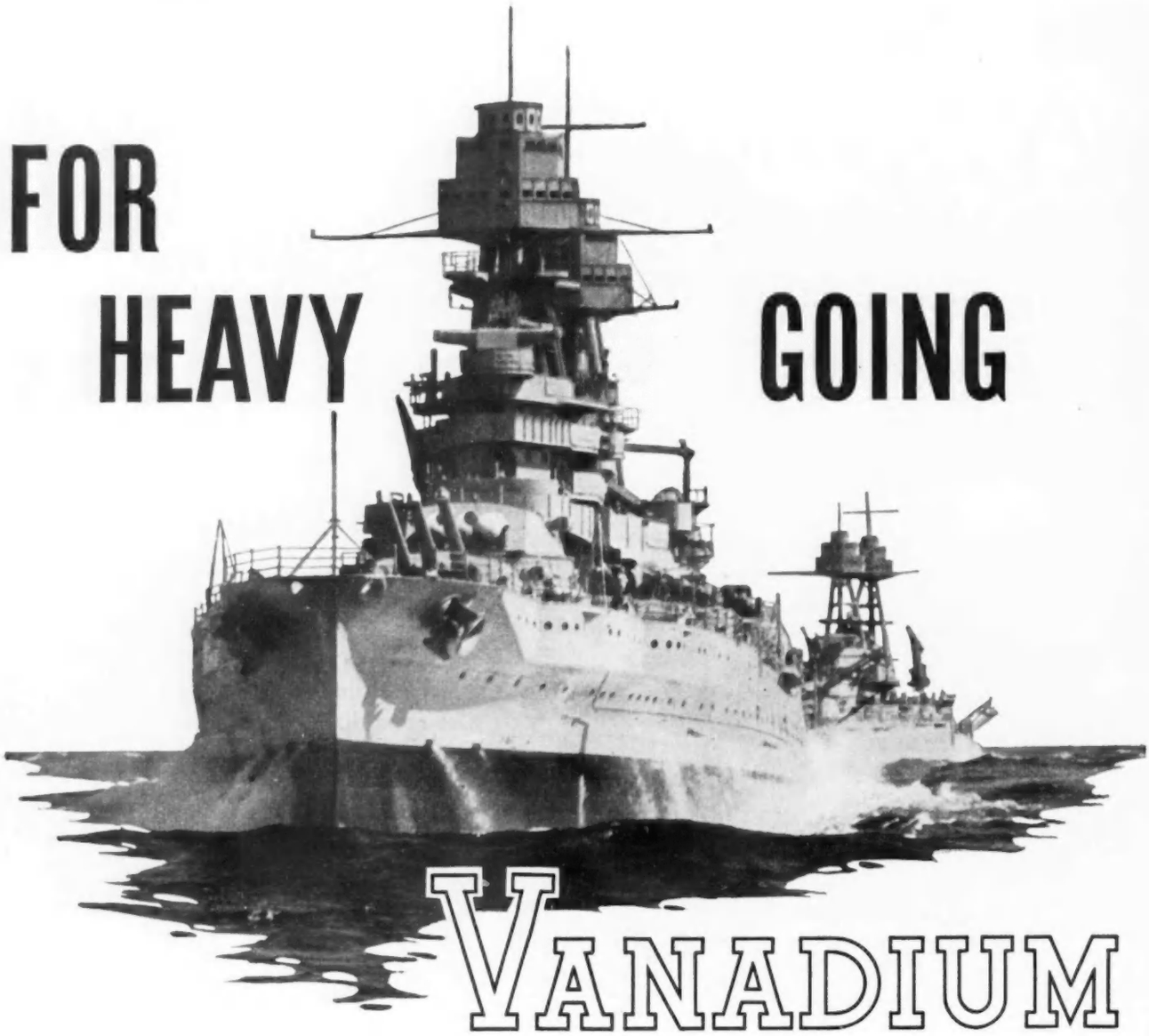
Write for Bulletin 203

THE SCHATZ MANUFACTURING CO.
POUGHKEEPSIE, N.Y.



UNUSUAL MACHINE TOOLS

FOR HEAVY GOING



VANADIUM

IF your equipment meets with heavy going and you need a strong, tough, fatigue-resisting steel, specify vanadium steel.

Vanadium in steel increases the tensile strength and elastic limit without loss of ductility. It shows marked improvement in resistance to shock and fatigue. These characteristics form an ideal combination for impact resistance.

In vanadium steels a wider range of permissible heat-treatment temperatures insures greater uniformity of physical properties.

Write for further details or have one of our service metallurgists call.

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Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

ACIDS—Pickling
American Chemical Paint Co., Ambler, Pa.

AIR TANKS AND CYLINDERS
Scaife, William B., & Sons Co., Ptgh.

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Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

ALLOYS—Magnesium
Dow Chemical Co., Midland, Mich.

ALLOYS—Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia.

ALLOYS—Silico-Manganese
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

ALLOYS—Titanium
Metal & Thermit Corp., 120 B'way, N. Y. C.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

ALLOYS—Tungsten
Vanadium Corp. of America, 120 Broadway, N. Y. C.

ALLOYS—Vanadium
Vanadium Corp. of America, 120 Broadway, N. Y. C.

ALLOYS—Zinc Base Die Casting
New Jersey Zinc Co., Inc., The, 160 Front St., N. Y. C.

AMMONIA RECOVERY PLANTS
Koppers Construction Co., The, Pittsburgh.

ANGLES, BEAMS, CHANNELS AND TEES
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Carnegie Steel Co., Pittsburgh.
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Ryerson, Jos. T., & Son, Inc., Chicago.
Steel & Tubes, Inc., Cleveland.
Weirton (W. Va.) Steel Co.

ANGLES, BEAMS, CHANNELS & TEES —Magnesium Alloys
Dow Chemical Co., Midland, Mich.

ANNEALING—See Heat Treating

ANODES—All Types
Udylite Process Co., Detroit.

ANODES—Cadmium
Udylite Process Co., Detroit.

ARBORS
Morse Twist Drill & Mch. Co., New Bedford, Mass.

ARRESTERS—Spark
Harrington & King Perforating Co., Chi.

AXLES—Car or Locomotive
Carnegie Steel Co., Pittsburgh.
Illinois Steel Co., Chicago.

BALLS—Steel, Brass or Bronze
Auburn Ball Bearing Co., 63 Clarissa St., Rochester, N. Y.
New Departure Mfg. Co., Bristol, Conn.
S K F Industries, Inc., 40 E. 34th St., N. Y. C.

BANDS—Steel
Bethlehem (Pa.) Steel Company.
Inland Steel Co., Chicago.

BANDS—Welded
Amer. Welding & Mfg. Co., Warren, O.

BARRELS—Burnishing
Globe Mch. & Stpg. Co., Cleveland.

BARRELS—Tumbling
Baird Mch. Co., Bridgeport, Conn.
Globe Mch. & Stpg. Co., Cleveland.

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BARS—Alloy
Allegheny Steel Co., Brackenridge, Pa.
Republic Steel Corp., Youngstown, Ohio.

BARS—Brass & Bronze
Johnson Bronze Co., New Castle, Pa.

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Union Drawn Steel Co., Massillon, Ohio.

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Inland Stel Co., Chicago.
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Laclede Steel Co., St. Louis, Mo.

BARS—Magnesium Alloys
Dow Chemical Co., Midland, Mich.

BARS—Steel
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Andrews Steel Co., The, Newport, Ky.
Bethlehem (Pa.) Steel Company.
Carnegie Steel Co., Pittsburgh.
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Joseph T., & Son, Inc., Chicago.
Steel & Tubes, Inc., Cleveland.
Timken Roller Bearing Co., Canton, Ohio.
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Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

BASES—Column, Machinery
Lukens Steel Co., Coatesville, Pa.

BATTERIES—Storage
Electric Storage Battery Co., Phila.

BATTERY CHARGERS
Cutler-Hammer, Inc., Milwaukee.

BEAMS—See Angles, Beams, Channels and Tees

BEARINGS—Babbitt
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.

BEARINGS—Ball
Auburn Ball Bearing Co., 63 Clarissa St., Rochester, N. Y.
Bantam Ball Bearing Co., South Bend, Ind.
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
New Departure Mfg. Co., Bristol, Conn.
S K F Industries, Inc., 40 East 34th St., N. Y. C.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

BEARINGS—Brass and Bronze
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.

BEARINGS—Laminated, Non-Metallic
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BEARINGS—Oilless
Rhoades, R. W. Metaline Co., Inc., Long Island City, N. Y.

BEARINGS—Radial
Bantam Ball Bearing Co., South Bend, Ind.
S K F Industries, Inc., 40 E. 34th St., N. Y. C.

BEARINGS—Roller
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
S K F Industries, Inc., 40 East 34th St., N. Y. C.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
Timken Roller Bearing Co., Canton, O.

BEARINGS—Roller Tapered
Timken Roller Bearing Co., Canton, O.

BEARINGS—Shaft Hanger
S K F Industries, Inc., 40 East 34th St., N. Y. C.

BEARINGS—Thrust
Auburn Ball Bearing Co., 63 Clarissa St., Rochester, N. Y.
S K F Industries, Inc., 40 East 34th St., N. Y. C.
Timken Roller Bearing Co., Canton, O.

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Akron (Ohio) Belting Co., The.

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Central Iron & Steel Co., Harrisburg, Pa.
Harrisburg (Pa.) Forge & Pipe Bending Co.
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Central Iron & Steel Co., Harrisburg, Pa.
Inland Steel Co., Chicago.
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Ames, W., & Co., Jersey City, N. J.
Clark Bros. Bolt Co., Milldale, Conn.
Oliver Iron & Steel Corp., Pittsburgh.
Republic Steel Corp., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., Chicago.

BOND—Grinding Wheel
Bakelite Corp., 247 Park Ave., N. Y. C.

BORING BARS
Bullard Co., The, Bridgeport.

BORING & DRILLING MACHINES—Vertical
Bullard Co., The, Bridgeport.

BORING & TURNING MILLS—Vertical
Bullard Co., The, Bridgeport.

BRAKES—Electric
Cutler-Hammer, Inc., Milwaukee.

BRAKES—Electric & Mechanical
Electric Controller & Mfg. Co., Cleveland.

BRAKES—Metal Forming
Dreis & Krump Mfg. Co., Chicago.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

BRICK—Fire Clay
Carborundum Co., The, Niagara Falls, N. Y.

BRICK—Insulating
Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

BRIDGE BUILDERS
American Bridge Co., Pittsburgh.
Belmont Iron Works, Philadelphia.
McClintic-Marshall Corp., Bethlehem, Pa.

BRIDGE OPERATING MACHINERY—Movable
Earle Gear & Mch. Co., Philadelphia.

BRONZE—Phosphor
Phosphor Bronze Smelting Co., Philadelphia.
Seymour (Conn.) Mfg. Co.

BUCKETS—Clamshell
Blaw-Knox Co., Pittsburgh
Hayward Co., The, 50 Church St., N. Y. C.

BUCKETS—Electric Motor
Hayward Co., The, 50 Church St., N. Y. C.

BUCKETS—Orange Peel
Hayward Co., The, 50 Church St., N. Y. C.

BUILDINGS—Steel
American Bridge Co., Pittsburgh.
Belmont Iron Works, Philadelphia.
McClintic-Marshall Corp., Bethlehem, Pa.

BUSHINGS—Brass and Bronze
Bunting Brass & Bronze Co., Toledo, O.
Johnson Bronze Co., New Castle, Pa.
Shenango-Penn Mold Co., Pittsburgh.

BUSHINGS—Oilless
Rhoades, R. W., Metaline Co., Inc., Long Island City, N. Y.

BUSHINGS—Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia.

BY-PRODUCTS COKE AND GAS OVENS
Koppers Construction Co., The, Pittsburgh.

CABLE—Electric
General Electric Co., Schenectady, N. Y.

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Udylite Process Co., Detroit.

CADMIUM PLATING PROCESS
Udylite Process Co., Detroit.

CALCIUM CARBIDE
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

CARBIC
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

CARBIDE
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

CARBURIZING—See Heat Treating

CARS—Industrial and Mining
Atlas Car & Mfg. Co., Cleveland.

CASE HARDENING—See Heat Treating

CASTINGS—Acid or Heat Resisting
Hoskins Mfg. Co., Detroit, Mich.
Midvale Co., The, Nicetown, Phila., Pa.

CASTINGS—Alloy Steel
Bissett Steel Co., The, Cleveland.
Midvale Co., The, Nicetown, Phila., Pa.

CASTINGS—Brass, Bronze, Copper or Aluminum
Cadman, A. W., Mfg. Co., Pittsburgh.
Phosphor Bronze Smelting Co., Philadelphia.
Snyder, W. P., & Co., Pittsburgh.
Spencer's, I. S., Sons, Inc., Guilford, Ct.

CASTINGS—Corrosion Resisting
Midvale Co., The, Nicetown, Phila., Pa.

CASTINGS—Die, Aluminum Bronze
Aurora (Ill.) Metal Co., Inc.

CASTINGS—Electric Steel
Industrial Steel Casting Co., The, Toledo.

CASTINGS—Gray Iron
American Engineering Co., Philadelphia.
Midvale Co., The, Nicetown, Phila., Pa.
National Roll & Fdry. Co., Avonmore, Pa.
North Wales (Pa.) Mach. Co., Inc.
Spencer's, I. S., Sons, Inc., Guilford, Ct.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.

CASTINGS—Magnesium Alloys
Dow Chemical Co., Midland, Mich.

CASTINGS—Malleable
Malleable Iron Fittings Co., Branford, Ct.
Peoria (Ill.) Malleable Castings Co.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.

CASTINGS—Semi-Steel
Malleable Iron Fittings Co., Branford, Ct.

CASTINGS—Steel
Allegheney Steel Co., Brackenridge, Pa.
Bethlehem (Pa.) Steel Company.
Crucible Steel Castings Co., Lansdowne, Pa.
Industrial Steel Casting Co., The, Toledo.
Malleable Iron Fittings Co., Branford, Ct.
Mesta Machine Co., Pittsburgh.
Midvale Co., The, Nicetown, Phila., Pa.

CEMENT—Quick Setting, Acid Proof & Insulator
Nukem Products Corp., 68 Niagara St., Buffalo, N. Y.

CEMENT—Refractory
Carborundum Co., The, Perth Amboy, N. J.

CEMENT—Rubber
Goodrich, B. F., Rubber Co., Akron, Ohio.

CHAINS—Power Transmission
Boston Gear Wks., Inc., North Quincy, Mass.

CHANNELS—See Angles, Beams, Channels and Tees

CHECKS—Metal
Noble & Westbrook Mfg. Co., Hartford, Ct.

CHEMICALS—Rust Proofing
Parker Rust-Proof Co., 2186 Milwaukee Ave., Detroit.
Udylite Process Co., Detroit.

CHROMIUM METAL
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

CHUCKING MACHINES—Multiple Spindle
Baird Machine Co., Bridgeport, Conn.

CHUCKS—Drill
Cleveland (Ohio) Twist Drill Co.
Jacobs Mfg. Co., Hartford, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

CIRCLES—Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia.

CLEANERS—Metal
American Chemical Paint Co., Ambler, Pa.
Ford, J. B., Co., Wyandotte, Mich.
Nukem Prods. Corp., 68 Niagara St., Buffalo, N. Y.

CLEANING EQUIPMENT (METAL)—Electro-Chemical
Bullard Co., The, Bridgeport.

CLEANING MATERIALS—Glass
Nukem Prods. Corp., 68 Niagara St., Buffalo, N. Y.

CLUTCHES—Magnetic
Cutler-Hammer, Inc., Milwaukee.
Dings Magnetic Separator Co., Milwaukee.

COAL
Hanna Furnace Corp., The, Detroit, Mich.
Pickands, Mather & Co., Cleveland.

COAL, ORE AND ASH HANDLING MACHINERY
Industrial Brownhoist Corp., Bay City, Mich.

COILS—Pipe
Harrisburg (Pa.) Pipe & Pipe Bending Co.
Pittsburgh (Pa.) Piping & Equipment Co.

COKE—Metallurgical
Pickands, Mather & Co., Cleveland.

COKE OVEN MACHINERY
Atlas Car & Mfg. Co., Cleveland.
Koppers Construction Co., The, Pittsburgh.

COKE OVENS—By-Products
Koppers Construction Co., The, Pittsburgh.

COKE OVENS—Cross Regenerators
Koppers Construction Co., The, Pittsburgh.

COKE OVENS—With Recovery of By-Products
Koppers Construction Co., The, Pittsburgh.

COMPOUNDS—Drawing
Socony-Vacuum Corp., 26 Broadway, N. Y. C.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

COMPRESSORS—Air
General Electric Co., Schenectady, N. Y.
Westinghouse Traction Brake Co., Industrial Div., Pittsburgh.

CONCRETE REINFORCEMENT
American Steel & Wire Co., Chicago.

CONTRACTORS' SUPPLIES — Second-Hand
Albert & Davidson Pipe Corp., 2nd Ave., 50-51st St., Bklyn., N. Y.
Albert Pipe Supply Co., Inc., Berry & N. 13th St., Bklyn, N. Y.

CONTROLLERS—Crane
Cutler-Hammer, Inc., Milwaukee.

CONTROLLERS—Electric
Cutler-Hammer, Inc., Milwaukee.
Electric Controller & Mfg. Co., Cleve.
General Electric Co., Schenectady, N. Y.

CONTROLLERS—Valve, Electrically Operated
Cutler-Hammer, Inc., Milwaukee.

CONVEYOR WORMS
Lee Spring Co., Inc., 30 Main St., Brooklyn, N. Y.

COPING MACHINES
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

CORE OIL
Socony-Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

CORUNDUM WHEELS — See Grinding Wheels

COTTERS AND KEYS—Spring
Hindley Mfg. Co., Valley Falls, R. I.
Hubbard, M. D., Spg. Co., Pontiac, Mich.
Western Wire Prods. Co., St. Louis, Mo.

COUNTERBORES
Cleveland (Ohio) Twist Drill Co.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

COUNTER—Production
Veeder-Root, Inc., Hartford, Ct.

COUNTING MACHINES
Veeder-Root, Inc., Hartford, Conn.

COUPLINGS—Pipe
Harrisburg (Pa.) Pipe & Pipe Bending Co.

COUPLINGS, PIPE—Genuine Wrought Iron
Byers, A. M., Co., Pittsburgh.

CRANES—Crawling Traster
Industrial Brownhoist Corp., Bay City, Mich.

CRANES—Electric Traveling
Armel, James P., Ptgh.
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Harnischfeger Corp., 4401 W. National Ave., Milwaukee, Wis.
Morgan Engineering Co., Alliance, O.
Payne, N. B., & Co., 105 West 55th St., N. Y. C.
Robbins & Myers, Inc., Springfield, Ohio.
Shaw-Box Crane & Hoist Co., Inc., 492 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., Harvey, Ill.

CRANES—Gantry
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Morgan Engineering Co., Alliance, Ohio.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Whiting Corp., Harvey, Ill.

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CRANES—Hand Power
Cleveland Crane & Engineering Co., Wickliffe, Ohio.
Shaw-Box Crane & Hoist Co., Inc., 402 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CRANES—Jib
Shaw-Box Crane & Hoist Co., Inc., 402 Broadway, Muskegon, Mich.

CRANES—Locomotive
Industrial Brownhoist Corp., Bay City, Mich.

CRANES—Monorail
Cleveland Electric Tramrail, Wickliffe, O.
Shaw-Box Crane & Hoist Co., Inc., 402 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

CRANK SHAFTS
Union Drawn Steel Co., Massillon, Ohio.

CRIMPING MACHINES
Quickwork Co., The, St. Marys, Ohio.

CUTTER BLADES—Milling, Boring and Reaming
Haynes Stellite Co., 30 East 42nd St., N. Y. C.

CUTTERS—Keyseating
Davis Keyseater Co., Rochester, N. Y.

CUTTERS—Milling
Cleveland (Ohio) Twist Drill Co.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

CUTTING-OFF MACHINES—Cold Saw
Espen-Lucas Mch. Wks., Philadelphia.

CUTTING-OFF MACHINES — Pipe or Tubing
Bardons & Oliver, Cleveland.
Landis Mch. Co., Inc., Waynesboro, Pa.

CUTTING AND WELDING APPARATUS —Oxy-Acetylene—See Welding and Cutting Machines and Equipment—Oxy-Acetylene.

CYLINDERS—Compressed Air, Gas, Etc.
National Tube Co., Pittsburgh.

CYLINDERS—Seamless
Harrisburg (Pa.) Pipe & Pipe Bending Co.
National Tube Co., Pittsburgh.

DEOXIDIZERS
Vanadium Corp. of America, 120 Broadway, N. Y. C.

DIE BLOCKS
Lukenweld, Inc., Coatesville, Pa.

DIES—Pipe Threading
Landis Mch. Co., Inc., Waynesboro, Pa.

DIES—Screw and Thread Cutting
Eastern Mach. Screw Corp., New Haven, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Machine Co., Inc., Waynesboro, Pa.

DIES—Self-Opening Adjustable
Eastern Mach. Screw Corp., New Haven, Ct.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Inc., Waynesboro, Pa.

DIES—Sheet Metal Working
Lukenweld, Inc., Coatesville, Pa.
Wiley & Lett, Inc., Marion, Ind.
Worcester (Mass.) Stamped Metal Co.

DIES—Steel Letters and Stamps
Noble & Westbrook Mfg. Co., Hartford, Ct.

DOLOMITE—Flux & Refractories
Basic Dolomite, Inc., Cleveland.

DRAWN WORK—Metal—See Stampings or Drawings—Metal

DRILLING MACHINES—Bench
Buffalo (N. Y.) Forge Co., 492 Broadway.
Leland-Gifford Co., Worcester, Mass.

DRILLING MACHINES—Portable Pneumatic
Helwig Mfg. Co., St. Paul, Minn.

DRILLING MACHINES—Sensitive
Buffalo (N. Y.) Forge Co., 492 Broadway.
Leland-Gifford Co., Worcester, Mass.

DRIVES—Gear
Farrel-Birmingham Co., Inc., Buffalo, N. Y.
Mesta Machine Co., Pittsburgh.

DROP FORGINGS—See Forgings—Drop, Iron or Steel

DROP HAMMERS—See Hammers—Drop

DUST COLLECTORS
American Foundry Equipment Co., Mishawaka, Ind.
Pangborn Corp., Hagerstown, Md.

ECONOMIZERS
Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

ELECTRIC HEATING ELEMENTS
Globar Corp., Niagara Falls, N. Y.

ELECTRIC LIGHTING
General Electric Co., Cleveland, Ohio.

ELECTRIC WELDING—See Welding—Electric

ELECTRICAL EQUIPMENT
General Electric Co., Schenectady, N. Y.

ELECTRICAL WIRES
American Steel & Wire Co., Chicago.
Roebling's, John A., Sons Co., Trenton, N. J.

ELECTRODES—Welding, Coated
Metal & Thermit Corp., 120 B'way, N. Y. C.

ELECTROPLATING EQUIPMENT & SUPPLIES
Udylite Process Co., Detroit.

ELEVATORS—Steam Hydraulic
Ridgeway, Craig & Son Co., Coatesville, Pa.

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ENAMELING
Geuder, Paeschke & Frey Co., Milwaukee.

ENGINEERS AND CONTRACTORS
Koppers Construction Co., The, Pittsburgh.

ENGINEERS—Consulting and Industrial
Koppers Construction Co., The, Pittsburgh.
Perin Engineering Co., Inc., 11 West 42nd St., N. Y. C.

ENGINEERS—Foundry Consulting
National Engineering Co., Chicago.

ENGINEERS—Management
Scovell, Wellington & Co., 10 East 40th St., N. Y. C.

FACING CLAY
Carborundum Co., The, Perth Amboy, N. J.

FEED WATER HEATERS AND PURIFIERS
Harrisburg (Pa.) Pipe & Pipe Bending Co.

FENCING—Wire
Pittsburgh (Pa.) Steel Co.

FERRO ALLOYS—Chromium
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Metal & Thermit Corp., 120 B'way, N. Y. C.
Pittsburgh Metallurgical Co., Inc., Niagara Falls, N. Y.
Samuel, Frank, & Co., Philadelphia.
Vanadium Corp. of America, 120 B'way, N. Y. C.

FERRO ALLOYS—Manganese
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Pittsburgh Metallurgical Co., Inc., Niagara Falls, N. Y.
Samuel, Frank, & Co., Phila.

FERRO ALLOYS—Molybdenum
Climax Molybdenum Co., 295 Madison Ave., N. Y. C.
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Silico Manganese
Electro Metallurgical Sales Corp., 30 E. 42nd St., N. Y. C.
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Silicon
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Pittsburgh Metallurgical Co., Inc., Niagara Falls, N. Y.
Samuel, Frank, & Co., Phila.
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Silicon-Aluminum
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Spiegeleisen
Electro Metallurgical Sales Corp., 30 E. 42nd St., N. Y. C.
New Jersey Zinc Co., Inc., The, 160 Front St., N. Y. C.

FERRO ALLOYS—Titanium
Metal & Thermit Corp., 120 B'way, N. Y. C.
Titanium Alloys Mfg. Co., Niagara Falls, N. Y.
Vanadium Corp. of America, 120 Broadway, N. Y. C.

FERRO ALLOYS—Tungsten
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Metal & Thermit Corp., 120 B'way, N. Y. C.

FERRO ALLOYS—Vanadium
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Metal & Thermit Corp., 120 B'way, N. Y. C.
Vanadium Corp. of America, 120 Broadway N. Y. C.

FERRO ALLOYS—Zirconium
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.

FILTERS—Pressure or Gravity
Scaife, Wm. B., & Sons Co., Ptgh.

FIRE CLAY
Carborundum Co., The, Perth Amboy, N. J.

FITTINGS—Brass, Pipe and Tube
Commonwealth Brass Corp., Detroit.

FITTINGS, CAST IRON—Rubber Lined
American Hard Rubber Co., 11 Mercer St., N. Y. C.

FITTINGS—Genuine Wrought Iron
Byers, A. M., Co., Pittsburgh.

FLANGES—Forged Steel
Harrisburg (Pa.) Pipe & Pipe Bending Co.

FLANGING WORK—Carbon and Alloy
Lukens Steel Co., Coatesville, Pa.

FLEXIBLE SHAFT EQUIPMENT
Fischer, Chas., Spring Co., 242 Kent Ave., Brooklyn, N. Y.

FLOODLIGHTS—Acetylene
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

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FLOORING—Acid Proof
Nukem Prods. Corp., 68 Niagara St., Buffalo, N. Y.

FLOORING—Steel
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Canton (Ohio) Drop Forging & Mfg. Co.
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FORGINGS—Hollow
Harrisburg (Pa.) Pipe & Pipe Bending Co.

FORGINGS—Hydraulic Press, Iron or Steel
Atlas Drop Forge Co., Lansing, Mich.
Bethlehem (Pa.) Steel Company.
Mesta Machine Co., Pittsburgh.
Midvale Co., The, Nicetown, Phila., Pa.

FORGINGS—Magnesium Alloys
Dow Chemical Co., Midland, Mich.

FORGINGS—Upset
Bethlehem (Pa.) Steel Company.
Rockford (Ill.) Drop Forge Co.

FUME DUCTS—Rubber Lined
American Hard Rubber Co., 11 Mercer St., N. Y. C.

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Flinn & Dreffein Co., Chicago.

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McClintic-Marshall Corp., Bethlehem, Pa.

FURNACES—Electric, Steel Melting.
American Bridge Co., Pittsburgh.
Detroit (Mich.) Elec. Furnace Co.
General Electric Co., Schenectady, N. Y.
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FURNACES—Enameling
Carborundum Co., The, Perth Amboy, N. J.

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Holcroft & Co., Detroit.

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Holcroft & Co., Detroit.

FURNACES—Heat Treating, Cyanide or Lead
Amer. Gas Furnace Co., Elizabeth, N. J.
Chicago (Ill.) Flexible Shaft Co.

FURNACES—Heat Treating, Electric
General Electric Co., Schenectady, N. Y.
Holcroft & Co., Detroit.
Hoskins Mfg. Co., Detroit, Mich.
Strong, Carlisle & Hammond Co., Cleve.

FURNACES—Heat Treating, Oil or Gas
Amer. Gas Furnace Co., Elizabeth, N. J.
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Detroit (Mich.) Elec. Furnace Co.

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General Electric Co., Schenectady, N. Y.

FURNACES—Wire, Annealing and Galvanizing
General Electric Co., Schenectady, N. Y.

GAGES—Plug and Snap
Haynes Stellite Co., 30 East 42nd St., N. Y. C.

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GAS RECOVERY COKE OVENS
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Garlock Packing Co., The, Palmyra, N. Y.

GASKETS—Rubber
American Hard Rubber Co., 11 Mercer St., N. Y. C.
Goodrich, B. F., Rubber Co., Akron, Ohio.

GEAR CUTTING
Earle Gear & Machine Co., Phila.
Farrel-Birmingham Co., Inc., Buffalo, N. Y.
Gleason Works, Rochester, N. Y.
Perkins Mch. & Gear Co., 147 Circuit Ave., Springfield, Mass.
Philadelphia (Pa.) Gear Works.
Pittsburgh (Pa.) Rolls Corp.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.

GEAR CUTTING MACHINES
Farrel-Birmingham Co., Inc., Buffalo, N. Y.
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GEAR DRIVES—Herringbone
Lewis Foundry & Mch. Co., Pittsburgh.

GEAR MATERIAL—Laminated, Non-Metallic
Synthane Corp., Oaks, Pa.

GEAR PLANING MACHINES
Gleason Works, Rochester, N. Y.

GEARS—Bevel
Boston Gear Wks., Inc., North Quincy, Mass.
Gleason Works, Rochester, N. Y.
Perkins Mch. & Gear Co., 147 Circuit Ave., Springfield, Mass.

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Gleason Works, Rochester, N. Y.

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GEARS—Machine Cut
Boston Gear Wks., Inc., North Quincy, Mass.
Gleason Works, Rochester, N. Y.

GEARS—Non-metallic
Boston Gear Wks., Inc., North Quincy, Mass.
General Electric Co., Schenectady, N. Y.

GEARS—Spur
Boston Gear Wks., Inc., North Quincy, Mass.
Perkins Mch. & Gear Co., 147 Circuit Ave., Springfield, Mass.
Philadelphia (Pa.) Gear Works.

GEARS—Welded Steel
Lukenweld, Inc., Coatesville, Pa.

GEARS—Worm
Boston Gear Wks., Inc., North Quincy, Mass.
Perkins Mch. & Gear Co., 147 Circuit Ave., Springfield, Mass.
Philadelphia (Pa.) Gear Works.

GENERATORS—Acetylene
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

GENERATORS—Electric
Lincoln Electric Co., Cleveland.
Westinghouse Elec. & Mfg. Co., East Pgh.

GENERATORS—Electric, Second Hand
Belyea Co., Inc., 147 W. 18th St., N. Y. C.
Motor Repair & Mfg. Co., Cleveland.
Rockford (Ill.) Electric Equip. Co.

GLUE HEATERS
Dart, E. M. Mfg. Co., Prov., R. I.

GOVERNORS—Air Compressor
Westinghouse Traction Brake Co., Industrial Div., Pittsburgh.

GREASE—Lubricating
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tire Water Oil Sales Corp., 17 Battery Place, N. Y. C.

GRINDING AND POLISHING MACHINES
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Excelsior Tool & Mch. Co., E. St. Louis, Ill.
Norton Co., Worcester, Mass.

GRINDING MACHINES—Cylindrical
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Abrasive Machine Tool Co., E. Prov., R. I.
Norton Co., Worcester, Mass.

GRINDING MACHINES—Tool
Norton Co., Worcester, Mass.

GRINDING MACHINES—Universal
Norton Co., Worcester, Mass.

GRINDING WHEEL DRESSERS AND CUTTERS
Calder, Geo. H., Lancaster, Pa.

GRINDING WHEELS
Bakelite Corp., 247 Park Ave., N. Y. C.
Carborundum Co., The, Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

GRIT—Steel
Pittsburgh (Pa.) Crushed Steel Co.

HACK SAW BLADES—See Saws—Hack Saw Blades

HACK SAW MACHINES
Armstrong-Blum Mfg. Co., Chicago.
Victor Saw Works, Inc., Middletown, N. Y.

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Nazel Engng. & Mch. Wks., Philadelphia.

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Erie (Pa.) Foundry Co.
Morgan Engineering Co., Alliance, Ohio.

HAMMERS—Power
Barbour-Stockwell Co., Cambridge, Mass.
Quickwork Co., The, St. Marys, Ohio.

HAMMERS—Steam
Erie (Pa.) Foundry Co.
Morgan Engineering Co., Alliance, Ohio.

HANGERS—Ball Bearing
S K F Industries, Inc., 40 E. 34th St., N. Y. C.

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HEADING MACHINES—Automatic, Electric
National Mchry. Co., Tiffin, Ohio.

HEADS—Spun and Pressed
Lukens Steel Co., Coatesville, Pa.

HEAT RESISTING PRODUCTS—Electric
Globar Corp., Niagara Falls, N. Y.

HEAT TREATING
Barnes-Gibson Raymond, Inc., Detroit.
Barnes, Wallace Co., The, Bristol, Conn.
General Machine Wks., York, Pa.
Gibson, Wm. D., Co., Chicago.
Parish Pressed Steel Co., Reading, Pa.

HEATING RESISTANCE—Non-Metallic
Globar Corp., Niagara Falls, N. Y.

HOISTS—Air
Detroit (Mich.) Hoist & Mach. Co.
Ridgway, Craig & Son Co., Coatesville, Pa.

HOISTS—Chain
Wright Mfg. Co., York, Pa.

HOISTS—Electric
American Engineering Co., Philadelphia.
Detroit (Mich.) Hoist & Mach. Co.
Harnischfeger Corp., 4401 W. National Ave., Milwaukee, Wis.
Philadelphia (Pa.) Gear Works.
Robbins & Myers, Inc., Springfield, Ohio.
Shaw-Box Crane & Hoist Co., Inc., 402 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.
Wright Mfg. Co., York, Pa.

HOISTS—Electric Traveling
Cleveland Electric Tramrail, Wickliffe, O.
Shaw-Box Crane & Hoist Co., Inc., 402 Broadway, Muskegon, Mich.

HOISTS—Monorail
Shaw-Box Crane & Hoist Co., Inc., 402 Broadway, Muskegon, Mich.
Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

HOOKS—Wire
Titchener, E. H., & Co., Binghamton, N. Y.

HOOPS—Wire
American Steel & Wire Co., Chicago.

HOSE—Rubber
Goodrich, B. F., Rubber Co., Akron, Ohio.

HYDRANTS—Fire
Wood, R. D., & Co., Philadelphia.

HYDRAULIC MACHINERY
Baldwin-Southwark Corp., Southwark Div., Philadelphia.
Morgan Engineering Co., Alliance, Ohio.
Wood, R. D., & Co., Philadelphia.

INGOT MOLDS
Shenango Furnace Co., Pittsburgh.
Shenango-Penn Mold Co., Pittsburgh.
Snyder, W. P., & Co., Pittsburgh.

INGOT PIPE ELIMINATORSS
Alpha-Lux Co., Inc., The, 192 Front St., N. Y. C.

INGOTS—Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia.

INSTRUMENTS—Recording
Bristol Co., Waterbury, Conn.

IRON—Genuine Open Hearth Iron
Newport (Ky.) Rolling Mill Co.

IRON—Genuine Wrought
Byers, A. M., Co., Pittsburgh.

IRON—Rustless
Ludlum Steel Co., Watervliet, N. Y.

IRON—Stainless
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.

IRON—Staybolt
Burden Iron Co., The, Troy, N. Y.

KEYS—Riveted
Western Wire Prods. Co., St. Louis, Mo.

KEYSEATING MACHINES
Davis Keyseater Co., Rochester, N. Y.

LAMPS—Filament
General Electric Co., Cleveland, Ohio.

LATHES—Automatic
Baird Machine Co., Bridgeport, Conn.
Bullard Co., The, Bridgeport.
Jones & Lamson Mch. Co., Springfield, Vt.
Townsend, H. P., Mfg. Co., Hartford, Conn.

LATHES—Automatic Vertical
Baird Mch. Co., Bridgeport, Conn.
Bullard Co., The, Bridgeport, Conn.

LATHES—Chucking
Jones & Lamson Mch. Co., Springfield, Vt.
Warner & Swasey Co., The, Cleveland.

LATHES—Roll
Lewis Foundry & Mch. Co., Pittsburgh.
Mesta Machine Co., Pittsburgh.

LATHES—Second-Hand
Botwinik Brothers, Inc., New Haven, Conn.
Eastern Mchry. Co., 3263 Spring Grove Ave., Cincinnati, O.
Miles Mchry. Co., Saginaw, W. S., Mich.

LATHES—Turret
Bardons & Oliver, Cleveland.
Bullard Co., The, Bridgeport.
Jones & Lamson Mch. Co., Springfield, Vt.

LATHES—Turret, Vertical
Bullard Co., The, Bridgeport, Conn.

LEVELING MACHINES
Schatz Mfg. Co., The, Poughkeepsie, N. P.
Wean Engineering Co., Inc., The, Warren, Ohio.

LOCOMOTIVES—Electric
Atlas Car & Mfg. Co., Cleveland.
General Electric Co., Schenectady, N. Y.

LOCOMOTIVES—Storage Battery
Atlas Car & Mfg. Co., Cleveland.

LUBRICANTS—Crusher & Grinding
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

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LUBRICANTS—Gear
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

LUBRICANTS—High Pressure & Temperature
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

LUBRICANTS—Mine Cars
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

LUBRICANTS—Mining Machines
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

LUBRICANTS—Railroad
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

LUBRICANTS—Roll Neck—Anti-Friction & Plain
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

LUBRICANTS—Tipple & Cleaning
Socony - Vacuum Corp., 26 Broadway N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

MACHINE WORK
Eisler Electric Corp., 765 South 13th St., Newark, N. J.

MACHINERY DEALERS
Crawford, F. H., & Co., 50 Church St., N. Y. C.
Delta Equipment Co., Philadelphia.
Donahue Steel Prods. Co., 1609 W. 74th St., Chicago.
Eastern Mchry. Co., 3263 Spring Grove Ave., Cincinnati, O.
Emerman, Louis E., & Co., Chicago.
Ideal Mchry. Co., Plainville, Conn.
Iroquois Mchry. Co., 656 Ohio St., Buffalo, N. Y.
Lucas, J. L., & Son, Inc., Bridgeport, Ct.
Marr-Galbreath Mchry. Co., Pittsburgh.
Miles Mchry. Co., Saginaw, W. S., Mich.
Morey Mchry. Co., 410 Broome St., N. Y. C.
Morris Mchry. Co., Inc., Newark, N. J.
Moyer, J. N., Phila.
O'Brien Machinery Co., Philadelphia.
Ritterbush & Co., Inc., 30 Church St., N. Y. C.
Rockford (Ill.) Power Mchry. Co., 623 Sixth St.
Ryerson, Joseph T., & Son, Inc., Chicago
Severin Mchry. Corp., 30 Church St., N. Y. C.
Simmons Mch. Tool Corp., Albany, N. Y.
Sun Mchry. Co., Inc., Newark, N. J.
White, A. D. Mchry. Co., Chicago.

MAGNESITE—Brick or Dead Burnt
Carborundum Co., The, Perth Amboy, N. J.

MAGNESIUM
Dow Chemical Co., Midland, Mich.

MAGNETS—Lifting
Cutler-Hammer, Inc., Milwaukee.
Electric Controller & Mfg. Co., Cleve.

MANGANESE METAL
Electro Metallurgical Sales Corp., 30 East 42nd St., N. Y. C.
Metal & Thermit Corp., 120 B'way, N. Y. C.

MANIFOLDS—Oxygen
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

MARKING MACHINES
Noble & Westbrook Mfg. Co., Hartford, Ct.

METAL PARTS—Rubber Covered
American Hard Rubber Co., 11 Mercer St., N. Y. C.

METAL SPECIALTIES
Amer. Spring & Mfg. Corp., Holly, Mich.
Crosby Co., The, Buffalo, N. Y.
Cuyahoga Spring Co., Cleve.
Geuder, Paeschke & Frey Co., Milwaukee.
Torrington (Ct.) Co.
Truscon Steel Co., Pressed Steel Div., Cleveland.
Worcester (Mass.) Stamped Metal Co.

METALS—Acid and Corrosion Resistant
Haynes Stellite Co., 30 East 42nd St., N. Y. C.
Lukenweld, Inc., Coatesville, Pa.

MICROMETER — Automatic, for Rolling Mills
Haines Gauge Co., The, Phila., Pa.

MILLING MACHINES—Second Hand
Botwinik Brothers, Inc., New Haven, Ct.
Eastern Mchry. Co., 3263 Spring Grove Ave., Cincinnati, O.
Emerman, Louis E., & Co., Chicago

MIXERS—Laboratory
National Engineering Co., Chicago

MIXING MACHINES—Sand
National Engineering Co., Chicago.

MOLDING MACHINES—Jarring (Air)
Arcade Mfg. Co., Freeport, Ill.

MOLDING MACHINES—Rollover (Hand and Power Operated)
Arcade Mfg. Co., Freeport, Ill.

MOLYBDENUM
Climax Molybdenum Co., 295 Madison Ave., N. Y. C.

MONEL-METAL
International Nickel Co., Inc., 67 Wall St., N. Y. C.

MOTORS—Electric
Lincoln Electric Co., Cleveland.
Westinghouse Elec. & Mfg. Co., East Pgh.

MOTORS—Electric, Second-Hand
Belyea Co., Inc., 147 W. 18th St., N. Y.
Botwinik Brothers, Inc., New Haven, Conn.
Delta Equipment Co., Philadelphia.
O'Brien Machinery Co., Philadelphia.
Rockford (Ill.) Electric Equip. Co.

NAILS—Wire
American Steel & Wire Co., Chicago.
Pittsburgh (Pa.) Steel Co.
Wickwire Brothers, Cortland, N. Y.
Youngstown (Ohio) Sheet & Tube Co.

NICKEL
International Nickel Co., Inc., 67 Wall St., N. Y. C.

NICKEL-CLAD STEEL
Lukens Steel Co., Coatesville, Pa.

NICKEL ANODES—Rolled or Cast
Seymour (Conn.) Mfg. Co.

NICKEL SILVER
Seymour (Conn.) Mfg. Co.

NITROGEN
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.

NUMBERING MACHINES—For Metal
Noble & Westbrook Mfg. Co., Hartford Ct.

NUT MAKING MACHINERY
National Mchry. Co., Tiffin, Ohio.

NUTS—Acorn
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS—Castellated
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS—Cold Punched
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS—Hot Pressed
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS—Semi-Finished
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

NUTS—Thumb Malleable
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

OIL AND GREASE CUPS
Gits Brothers Mfg. Co., Chicago.

OIL AND GREASE SEALS
Gits Brothers Mfg. Co., Chicago.

OIL STONES
Carborundum Co., The, Niagara Falls, N. Y.
Norton Co., Worcester, Mass.

OILS—Soluble—See Oils—Cutting

OILS—Cutting
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

OILS—Fuel
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Sun Oil Co., Philadelphia.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

OILS—Lubricating
Socony - Vacuum Corp., 26 Broadway, N. Y. C.
Tide Water Oil Sales Corp., 17 Battery Place, N. Y. C.

ORES—Iron
Hanna Furnace Corp., The, Detroit, Mich.
Pickands, Mather & Co., Cleveland.
Shenango Furnace Co., Pittsburgh.
Snyder, W. P., & Co., Pittsburgh.

OVENS—Coke and By-Product Recovery
Koppers Construction Co., The, Pittsburgh.

OVENS—Core and Mold
Holcroft & Co., Detroit.

OVENS—Cross Regenerative
Koppers Construction Co., The, Pittsburgh.

OVENS—Enameling and Japanning
Carborundum Co., The, Perth Amboy, N. J.

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OXY-ACETYLENE — Shape-Cutting Machines
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

OXYGEN
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

PACKING—Metallic
Garlock Packing Co., The, Palmyra, N. Y.

PACKING—Rubber
Goodrich, B. F., Rubber Co., Akron, Ohio.

PACKING—Sheet, Asbestos or Rubber
Garlock Packing Co., The, Palmyra, N. Y.

PERFORATED METAL
Harrington & King Perforating Co., Chi.
Mundt, Chas., & Sons, 50 Fairmount Ave., Jersey City, N. J.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

PHOSPHOR—Copper
Phosphor Bronze Smelting Co., Philadelphia.

PICKLING COMPOUNDS
American Chemical Paint Co., Ambler, Pa.

PICKLING MACHINES
Mesta Machine Co., Pittsburgh.

PIG IRON
Brooke, E. & G., Iron Co., Birdsboro, Pa.
Hanna Furnace Corp., The, Detroit, Mich.
Pickands, Mather & Co., Cleveland.
Republic Steel Corp., Youngstown, Ohio.
Shenango Furnace Co., Pittsburgh.
Shenango-Penn Mold Co., Pittsburgh.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

PILING—Steel Sheet
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.

PINIONS—Rolling Mill
Mesta Machine Co., Pittsburgh.

PINIONS—Wire and Rod
Rathbone, A. B. & J., Palmer, Mass.

PINS—Airbrake
Champion Rivet Co., Cleveland, Ohio.

PIPE—Cast Iron, B. & S. and Flanged
Wood, R. D., & Co., Philadelphia.

PIPE—Genuine Wrought Iron
Byers, A. M., Co., Pittsburgh.

PIPE—Hammer Welded
National Tube Co., Pittsburgh.

PIPE—New and Second-Hand
Albert & Davidson Pipe Corp., 2nd Ave., 50-51st St., Bklyn., N. Y.
Albert Pipe Supply Co., Inc., Berry and N. 13th St., Bklyn, N. Y.
Greenpoint Iron & Pipe Co., Inc., 187-197 Maspeth Ave., Bklyn, N. Y.

PIPE—Riveted Steel
McClintic-Marshall Corp., Bethlehem, Pa.

PIPE, STEEL—Rubber Lined
American Hard Rubber Co., 11 Mercer St., N. Y. C.

PIPE—Spiral Welded
American Rolling Mill Co., Middletown, O.

PIPE—Standard, Black and Galvanized
Jones & Laughlin Steel Corp., Pittsburgh.
National Tube Co., Pittsburgh.
Republic Steel Corp., Youngstown, Ohio.
Youngstown (Ohio) Sheet & Tube Co.

PIPE—Welded, Electric
Republic Steel Corp., Youngstown, Ohio.

PIPE BENDING & FABRICATING
Pittsburgh (Pa.) Piping & Equipment Co.

PIPE CUTTING AND THREADING MACHINES
Jarecki Mfg. Co., Erie, Pa.
Landis Mach. Co., Inc., Waynesboro, Pa.
Merrell Mfg. Co., Toledo.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.

PIPE ELIMINATORS
Alpha-Lux Co., Inc., The, 192 Front St., N. Y. C.

PIPE FITTINGS
Jarecki Mfg. Co., Erie, Pa.

PLANING MACHINES—Second-Hand
Miles Mchry. Co., Saginaw, W. S. Mich.

PLATER'S CLEANING COMPOUND
American Chemical Paint Co., Ambler, Pa.

PLATES—Floor or Cellar Door
Alan Wood Steel Co., Conshohocken, Pa.
Carnegie Steel Co., Pittsburgh.
Central Iron & Steel Co., Harrisburg, Pa.
Inland Steel Co., Chicago.

PLATES—Genuine Wrought Iron
Byers, A. M., Co., Pittsburgh.

PLATES—Heavy Steel (up to 25 in. thick)
Lukens Steel Co., Coatesville, Pa.

PLATES—Iron or Steel
Alan Wood Steel Co., Conshohocken, Pa.
American Rolling Mill Co., Middletown, O.
Bethlehem (Pa.) Steel Company.
Carnegie Steel Co., Pittsburgh.
Central Iron & Steel Co., Harrisburg, Pa.
Granite City (Ill.) Steel Co.
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Lukens Steel Co., Coatesville, Pa.
Lukenweld, Inc., Coatesville, Pa.
Ryerson, Joseph T. & Sons, Inc., Chicago.
Tennessee Coal Iron & Railroad Co., Birmingham, Ala.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

PLATES—Nickel-Clad Steel
Lukens Steel Co., Coatesville, Pa.
Lukenweld, Inc., Coatesville, Pa.

PLATES—Wide Steel (up to 198 in.)
Lukens Steel Co., Coatesville, Pa.

PLUGS—Core Hole
Hubbard, M. D., Spring Co., Pontiac, Mich.

POLISHING MACHINES—Belt
Production Machine Co., Greenfield, Mass.

PRESSED METAL PARTS
Champion Sheet Metal Co., Inc., Courtland, N. Y.
Crosby Co., The, Buffalo, N. Y.

PRESSED STEEL PARTS
Crosby Co., The, Buffalo, N. Y.
Geuder, Paeschke & Frey Co., Milwaukee.
Lansing (Mich.) Stamping Co., So. Penn Ave.
Parish Pressed Steel Co., Reading, Pa.
Truscon Steel Co., Pressed Steel Div., Cleveland.

PRESSES—Drop—See Hammers—Drop

PRESSES—Coining
National Mchry. Co., Tiffin, Ohio.

PRESSES—Foot
Baird Machine Co., Bridgeport, Conn.

PRESSES—Forging
Mesta Machine Co., Pittsburgh.
Morgan Engineering Co., Alliance, Ohio.

PRESSES—Forming and Bending
Dreis & Krump Mfg. Co., Chicago.

PRESSES—Friction Screw
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

PRESSES—Hydraulic
Baldwin-Southwark Corp., Southwark Div., Philadelphia.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Mesta Machine Co., Pittsburgh.
Morgan Engineering Co., Alliance, O.
Wood, R. D., & Co., Philadelphia.

PRESSES—Power
Baird Machine Co., Bridgeport, Conn.
Dreis & Krump Mfg. Co., Chicago, Ill.
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hyman, Joseph, & Sons, Phila.
New Albany (Ind.) Mch. Mfg. Co.
Niagara Machine & Tool Works, Buffalo, N. Y.
Pels, Henry, & Co., 90 West St., N. Y. C.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
V & O Press Co., Hudson, N. Y.

PRESSES—Trimming
Erie (Pa.) Foundry Co.

PULLEYS—Magnetic
Cutler-Hammer, Inc., Milwaukee.

PUNCHES & DIES
Cleveland Steel Tool Co., The, 660 E. 82d St., Cleveland, Ohio.

PUNCHING AND SHEARING MACHINES
Bertsch & Co., Cambridge City, Ind.
Excelsior Tool & Mach. Co., E. St. Louis, Ill.
Pels, Henry, & Co., 90 West St., N. Y. C.
Quickwork Co., The, St. Marys, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.
Thomas Spacing Mach. Co., Pittsburgh.

PYROMETERS—Indicating
Bristol Co., Waterbury, Conn.
Hoskins Mfg. Co., Detroit, Mich.

RAIL SPLICE BARS
Ames, W., & Co., Jersey City, N. J.

RAILS
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.
Robinson & Orr, Pittsburgh.
Ryerson, Jos. T., & Son, Inc., Chicago.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.
Weirton (W. Va.) Steel Co.

RAILS—Relaying
Hyman-Michaels Co., Chicago.
Sherwood, E. C., 5 Dey St., N. Y. C.

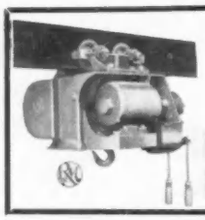
REAMERS
Cleveland (Ohio) Twist Drill Co.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

REFRACTORIES—Dolomite
Basic Dolomite, Inc., Cleveland.

REGULATORS—Compressed Gas
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

REINFORCEMENT FABRIC—Concrete
Pittsburgh (Pa.) Steel Co.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

RINGS—Iron or Steel
Lukenweld, Inc., Coatesville, Pa.
Midvale Co., The, Nicetown, Phila., Pa.



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RINGS—Welded
American Welding & Mfg. Co., Warren, O.
Lukenweld, Inc., Coatesville, Pa.

RIVET MAKING MACHINERY
Acme Machinery Co., Cleve.
National Mchry. Co., Tiffin, Ohio.

RIVET SETS
Cleveland Steel Tool Co., The, 660 E. 82d St., Cleveland, Ohio.

RIVETING MACHINES
Shuster, F. B., Co., New Haven, Conn.
Townsend, H. P., Mfg. Co., Hartford, Conn.

RIVETS
Champion Rivet Co., Cleveland, Ohio.
Clark Bros. Bolt Co., Milldale, Conn.
Oliver Iron & Steel Corp., Pittsburgh.
Progressive Mfg. Co., Torrington, Conn.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Inc., Chicago.

RODS—Magnesium Alloys
Dow Chemical Co., Midland, Mich.

RODS—Nickel Silver
Seymour (Conn.) Mfg. Co.

RODS—Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia.
Seymour (Conn.) Mfg. Co.

RODS—Welding
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
American Steel & Wire Co., Chicago.
Champion Rivet Co., Cleveland.
Haynes Stellite Co., 30 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.
Metal & Thermit Corp., 120 B'way, N. Y. C.
Pittsburgh (Pa.) Steel Co.
Wilson Welder & Metals Co., Inc., North Bergen, N. J.

RODS—Wire
American Steel & Wire Co., Chicago.
Jones & Laughlin Steel Corp., Pittsburgh.
Pittsburgh (Pa.) Steel Co.
Wickwire Brothers, Cortland, N. Y.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.
Youngstown (Ohio) Sheet & Tube Co.

ROLLING MACHINERY—Cold Rolling
Lewis Foundry & Mch. Co., Pittsburgh.

ROLLING MACHINERY—Sheet Metal
Lewis Foundry & Mch. Co., Pittsburgh.

ROLLING MILL MACHINERY
Farrel-Birmingham Co., Inc., Ansonia, Conn.
Hyde Park (Pa.) Fdry. & Mch. Co.
Lewis Foundry & Mch. Co., Pittsburgh.
Mesta Machine Co., Pittsburgh.
Morgan Engineering Co., Alliance, O.
National Roll & Fdry. Co., Avonmore, Pa.
United Engineering & Fdry. Co., Ptgh.

ROLLS—Alloy Steel
Pittsburgh (Pa.) Rolls Corp.

ROLLS—Bending and Straightening
Baldwin-Southwark Corp., Southwark Div., Philadelphia.
Bertsch & Co., Cambridge City, Ind.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

ROLLS—Sand Chilled Iron and Steel
Hyde Park (Pa.) Fdry. & Mach. Co.
Lewis Foundry & Mch. Co., Pittsburgh.
Mesta Machine Co., Pittsburgh.
National Roll & Fdry. Co., Avonmore, Pa.
Pittsburgh (Pa.) Rolls Corp.
United Engng. & Fdry. Co., Ptgh.

ROLLS—Special Hardened
Midvale Co., The, Nicetown, Phila., Pa.

ROOFING—Special Copper Bearing Steel
Newport (Ky.) Rolling Mill Co.

ROOFING AND SIDING—Corrugated and Plain
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pgh.
Newport (Ky.) Rolling Mill Co.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

ROOFING AND SIDING—Genuine Open Hearth Iron
Newport (Ky.) Rolling Mill Co.

ROOFING & SIDING—Genuine Wrought Iron
Byers, A. M., Co., Pittsburgh.

ROOFING AND SIDING—Iron and Steel
Newport (Ky.) Rolling Mill Co.

ROOFING AND SIDING—(Zinc) Corrugated and Plain.
New Jersey Zinc Co., Inc., The, 160 Front St., N. Y. C.

RUBBER LININGS—Tank
American Hard Rubber Co., 11 Mercer St., N. Y. C.
Goodrich, B. F., Rubber Co., Akron, Ohio.

RUBBER MOLDED PARTS
American Hard Rubber Co., 11 Mercer St., N. Y. C.

RUST PREVENTIVES
American Chemical Paint Co., Ambler, Pa.
American Lanolin Corp., Lawrence, Mass.
Parker Rust-Proof Co., 2186 Milwaukee Ave., Detroit.

RUST PROOFING COMPOUNDS
Parker Rust-Proof Co., 2186 Milwaukee Ave., Detroit.

RUST PROOFING PROCESS
Parker Rust-Proof Co., 2186 Milwaukee Ave., Detroit.
Udylite Process Co., Detroit.

RUST REMOVING
American Chemical Paint Co., Ambler, Pa.
Nukem Prods. Corp., 68 Niagara St., Buffalo, N. Y.

SAND BLAST EQUIPMENT AND MACHINES
American Foundry Equipment Co., Mishawaka, Ind.
Arcade Mfg. Co., Freeport, Ill.
Pangborn Corp., Hagerstown, Md.

SAND BLAST STEEL SHOT
American Foundry Equipment Co., Mishawaka, Ind.
Pittsburgh (Pa.) Crushed Steel Co.

SAND HANDLING EQUIPMENT
National Engineering Co., Chicago.

SAND MILLS
National Engineering Co., Chicago.

SAWING MACHINES—Band for Wood or Metal
Victor Saw Works, Inc., Middletown, N. Y.

SAWING MACHINES—Metal
Espen-Lucas Mch. Works, Phila.

SAWS—Band and Hack for Metal
Armstrong-Blum Mfg. Co., Chicago.

SAWS—Hack Saw Blades
Victor Saw Works, Inc., Middletown, N. Y.

SAWS—Inserted Tooth, Cold
Tabor Mfg. Co., Philadelphia.

SCREENS—Perforated Metal
Harrington & King Perforating Co., Chi.
Mundt, Chas., & Sons, 59 Fairmount Ave., Jersey City, N. J.

SCREENS—Woven Wire
Michigan Wire Cloth Co., 2117 Howard St., Detroit.
Wickwire Brothers, Cortland, N. Y.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

SCREW MACHINE PRODUCTS
Barnes, Wallace, Co., The, Bristol, Conn.
Commonwealth Brass Corp., Detroit.
Eastern Mch. Screw Corp., New Haven, Ct.
Olson Mfg. Co., Worcester, Mass.
Ottemiller, Wm. H., Co., Inc., York, Pa.
Progressive Mfg. Co., Torrington, Conn.
Screw Mch. Products Corp., Prov., R. I.

Products Index

SCREW MACHINERY—Automatic
Cone Automatic Mach. Co., Inc., Windsor, Vt.
Townsend, H. P., Mfg. Co., Hartford, Conn.

SCREW MACHINERY—Hand
Jones & Lamson Mch. Co., Springfield, Vt.

SCREW MACHINERY—Multiple Spindle
Cone Automatic Mach. Co., Inc., Windsor, Vt.

SCREW MACHINERY—Wood
Townsend, H. P., Mfg. Co., Hartford, Conn.

SCREW STOCKS
Union Drawn Steel Co., Massillon, Ohio.

SCREWS—Cap
Ottemiller, Wm. H., Co., Inc., York, Pa.

SCREWS—Machine
Progressive Mfg. Co., The, Hartford, Conn.

SCREWS—Safety Set
Progressive Mfg. Co., The, Hartford, Conn.
Standard Pressed Steel Co., Jenkintown, Pa.
Strong, Carlisle & Hammond Co., Cleve.

SCREWS—Set
Ottemiller, Wm. H., Co., Inc., York, Pa.
Strong, Carlisle & Hammond Co., Cleve.

SCREWS, Socket, Head, Cap
Standard Pressed Steel Co., Jenkintown, Pa.

SCRUBBING MACHINES—Sheet
Wean Engineering Co., Inc., The, Warren, Ohio.

SCYTHE STONES AND WHETSTONES
Carborundum Co., The, Niagara Falls, N. Y.

SECOND-HAND MACHINERY — See Clearing House Section
Botwinik Brothers, Inc., New Haven, Conn.
Donahue Steel Prods. Co., 1609 W. 74th St., Chicago.
Eastern Machinery Co., 3263 Spring Grove Ave., Cincinnati, O.
Emerman, Louis E., & Co., Chicago.
Falk Mill Supply Co., Inc., Rochester, N. Y.
Foster, Frank B., 829 Oliver Bldg., Ptgh.
Green, Samuel, Royersford, Pa.
Iroquis Mchry. Co., 656 Ohio St., Buffalo, N. Y.
Lucas, J. L., & Son, Inc., Bridgeport, Ct.
Marr-Galbreath Mchry. Co., Ptgh.
Miles Mchry. Co., Saginaw, W. S. Mich.
O'Brien Machinery Co., Philadelphia.
Ritterbush & Co., Inc., 30 Church St., N. Y. C.
Rockford (Ill.) Power Mchry. Co., 623 Sixth St.
Ross Power Equip. Co., Indianapolis, Ind.
Simmons Mch. Tool Corp., Albany, N. Y.
Sun Mchry. Co., Inc., Newark, N. J.
Sutton Eng. Co., Pittsburgh, Pa.
White A. D., Mchry. Co., Chicago.

SEPARATORS—Magnetic
Dings Magnetic Separator Co., Milwaukee.

SHAFTING—Cold Drawn
Union Drawn Steel Co., Massillon, Ohio.
Wyckoff Drawn Steel Co., Ambridge, Pa.

SHAFTING—Steel
Bliss & Laughlin, Inc., Harvey, Ill.
Union Drawn Steel Co., Massillon, Ohio.

SHAFTING—Tubular, Material for
National Tube Co., Pittsburgh.

SHAFTING—Turned and Ground
Moltrup Steel Products Co., Beaver Falls, Pa.
Ryerson, Jos. T. & Son, Inc., Chicago.
Union Drawn Steel Co., Massillon, Ohio.
Wyckoff Drawn Steel Co., Ambridge, Pa.

SHAPES—Cold Drawn
Union Drawn Steel Co., Massillon, Ohio.
Wyckoff Drawn Steel Co., Ambridge, Pa.

SHAPES—Wire
Eastern Tool & Mfg. Co., Bloomfield, N.J.
Lee Spring Co., Inc., 30 Main St., Brooklyn, N. Y.
Roebling's, John A., Sons Co., Trenton, N. J.
Titchener, E. H., & Co., Binghamton, N. Y.

SHEAR BLADES & KNIVES
Quickwork Co., The, St. Marys, Ohio.

SHEARING MACHINES — Angle, Head and Power
Buffalo (N. Y.) Forge Co., 492 Broadway.
Federal Bearings Co., Inc., Poughkeepsie, N. Y.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

SHEARING MACHINES—Bar
Buffalo (N. Y.) Forge Co., 492 Broadway.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

SHEARING MACHINES — Beam and Channel
Buffalo (N. Y.) Forge Co., 492 Broadway.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

SHEARING MACHINES—Billet
Buffalo (N. Y.) Forge Co., 492 Broadway.
Morgan Engineering Co., Alliance, Ohio.
Pels, Henry, & Co., 90 West St., N. Y. C.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

SHEARING MACHINES—Metal Slitting
Quickwork Co., The, St. Marys, Ohio.

SHEARING MACHINES—Plate
Bertsch & Co., Cambridge City, Ind.
Buffalo (N. Y.) Forge Co., 492 Broadway.
Dreis & Krump Mfg. Co., Chicago.
Mesta Machine Co., Pittsburgh.
Morgan Engineering Co., Alliance, O.
Pels, Henry, & Co., 90 West St., N. Y. C.
Quickwork Co., The, St. Marys, Ohio.
Schatz Mfg. Co., The, Poughkeepsie, N. Y.

SHEARING MACHINES — Rotary for Irregular Cutting
Quickwork Co., The, St. Marys, Ohio.

SHEARING MACHINES — Sheet and Plate
Buffalo (N. Y.) Forge Co., 492 Broadway.
Dreis & Krump Mfg. Co., Chicago.
Quickwork Co., The, St. Marys, Ohio.

SHEARING MACHINES—Squaring
Dreis & Krump Mfg. Co., Chicago.
Niagara Mach. & Tool Wks., Buffalo, N. Y.

SHEET BARS
Andrews Steel Co., The, Newport, Ky.
Jones & Laughlin Steel Corp., Pittsburgh.

SHEET METAL MACHINERY
Dreis & Krump Mfg. Co., Chicago.
New Albany (Ind.) Mch. Mfg. Co.
Niagara Mach. & Tool Wks., Buffalo, N. Y.
Quickwork Co., The, St. Marys, Ohio.
Ryerson, Jos. T. & Son, Inc., Chicago.
V & O Press Co., Hudson, N. Y.

SHEETS—Auto Body
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pgh.
Inland Steel Co., Chicago.
Republic Steel Corp., Youngstown, Ohio.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

SHEETS—Black
American Sheet & Tin Plate Co., Pgh
Empire Sheet & Tin Plate Co., Mansfield, Ohio.
Granite City (Ill.) Steel Co.
Ingersoll Steel & Disc Co., Chicago.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Weirton (W. Va.) Steel Co.

SHEETS—Blue Annealed
Alan Wood Steel Co., Conshohocken, Pa
American Rolling Mill Co., Middletown, O.
Central Iron & Steel Co., Harrisburg, Pa.
Granite City (Ill.) Steel Co.
Inland Steel Co., Chicago.
Lukens Steel Co., Coatesville, Pa.
Newport (Ky.) Rolling Mill Co.
Ryerson, Jos. T., & Son, Inc. Chicago.
Weirton (W. Va.) Steel Co.

SHEETS—Brass, Bronze, Copper, Nickel, Silver or Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia.
Seymour (Conn.) Mfg. Co.

SHEETS—Cold Rolled
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Empire Sheet & Tin Plate Co., Mansfield, Ohio.
Inland Steel Co., Chicago.
Republic Steel Corp., Youngstown, O.
Ryerson, Jos. T., & Son, Inc., Chicago.

Products Index

SHEETS—Copper Steel
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.

SHEETS—Electrical
Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middletown, O.
Empire Sheet & Tin Plate Co., Mansfield, Ohio.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.

SHEETS — Enameling Stock (Genuine Open-Hearth Iron)
American Rolling Mill Co., Middletown, O.
Empire Sheet & Tin Plate Co., Mansfield, Ohio.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.

SHEETS—For Drawing and Stamping
Allegheny Steel Co., Brackenridge, Pa.
American Rolling Mill Co., Middletown, O.
Empire Sheet & Tin Plate Co., Mansfield, Ohio.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Weirton (W. Va.) Steel Co.

SHEETS—Full Finished
American Rolling Mill Co., Middletown, O.
Empire Sheet & Tin Plate Co., Mansfield, Ohio.
Inland Steel Co., Chicago.
National Steel Corp., Pittsburgh.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

SHEETS—Galvanized, Flat and Corrugated
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pgh.
Bethlehem (Pa.) Steel Company.
Granite City (Ill.) Steel Co.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

SHEETS—Genuine Wrought Iron
Byers, A. M., Co., Pittsburgh.

SHEETS—Long Terne
Newport (Ky.) Rolling Mill Co.
Weirton (W. Va.) Steel Co.

SHEETS—Magnesium Alloys
Dow Chemical Co., Midland, Mich.

SHEETS—Metal Furniture
Allegheny Steel Co., Brackenridge, Pa.
Empire Sheet & Tin Plate Co., Mansfield, Ohio.
Inland Steel Co., Chicago.
Newport (Ky.) Rolling Mill Co.
Republic Steel Corp., Youngstown, Ohio.

SHEETS—Pickled
Empire Sheet & Tin Plate Co., Mansfield, Ohio.
Newport (Ky.) Rolling Mill Co.
Weirton (W. Va.) Steel Co.

SHEETS—Tin Mill Black
American Rolling Mill Co., Middletown, O.
Empire Sheet & Tin Plate Co., Mansfield, Ohio.
Newport (Ky.) Rolling Mill Co.
Weirton (W. Va.) Steel Co.

SHEETS—Zinc
New Jersey Zinc Co., Inc., The, 160 Front St., N. Y. C.

SHELLS—Brass and Copper
Foster, Theodore W., & Bro. Co., Providence, R. I.

SHOES—Horse and Mule
Burden Iron Co., The, Troy, N. Y.

SLABS
Andrews Steel Co., The, Newport, Ky.
Byers, A. M., Co., Pittsburgh.
Central Iron & Steel Co., Harrisburg, Pa.

SLINGS—Wire Rope
Roebling's, John A., Sons Co., Trenton, N. J.

SLOTTING MACHINES
Nazel Engng. & Mch. Wks., Philadelphia.

SPACING TABLES—Punching & Shearing
Thomas Spacing Mach. Co., Pittsburgh.

SPECIAL MACHINERY
Baldwin-Southwark Corp., Southwark Div., Philadelphia
Bullard Co., The, Bridgeport.
Eastern Tool & Mfg. Co., Bloomfield, N. J.
Morgan Engineering Co., Alliance, Ohio.
Quickwork Co., The, St. Marys, Ohio.
Wood, R. D., & Co., Philadelphia Pa.

SECIALTIES—Rubber Covered & Lined
American Hard Rubber Co. 11 Mercer St., N. Y. C.

SPEED REDUCERS
Boston Gear Wks., Inc., North Quincy, Mass.
Philadelphia (Pa.) Gear Works.

SPIKES—Track
Ames, W., & Co., Jersey City, N. J.
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.

SPLICE BARS
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.

SPRING MAKING MACHINERY
Baird Machine Co., Bridgeport, Conn.

SPRINGS—Car
American Steel & Wire Co., Chicago.
Miller & Van Winkle, Inc., 18 Bridge St., Brooklyn, N. Y.

SPRINGS—Extension, Compression, Torsion or Flat
Amer. Spring & Mfg. Corp., Holly, Mich.
American Steel & Wire Co., Chicago.
Barnes-Gibson-Raymond, Inc., Detroit.
Barnes, Wallace, Co., The, Bristol, Conn.
Cook Spring Co. Div. of Barnes-Gibson-Raymond, Inc., Ann Arbor, Mich.
Cuyahoga Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Fischer, Chas., Spring Co., 242 Kent Ave., Brooklyn, N. Y.
Gibson, Wm. D., Co., Chicago.
Hubbard, M. D., Spring Co., Pontiac, Mich.
Lee Spring Co., Inc., 30 Main St., Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge St., Brooklyn, N. Y.
Raymond Mfg. Co., Corry, Pa.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

SPROCKETS
Boston Gear Wks., Inc., North Quincy, Mass.

STACKS—Steel
McClintic-Marshall Corp., Bethlehem, Pa.

STAMPINGS OR DRAWINGS—Metal
Barnes-Gibson-Raymond, Inc., Detroit.
Barnes, Wallace, Co., The, Bristol Conn.
Champion Sheet Metal Co., Inc., Cortland, N. Y.
Cook Spring Co. Div. of Barnes-Gibson-Raymond, Inc., Ann Arbor, Mich.
Cook, H. C., Co., Ansonia, Conn.
Crosby Co., The, Buffalo, N. Y.
Cuyahoga Spring Co., Cleveland.
Dunbar Bros. Co., Bristol, Conn.
Eastern Tool & Stpg. Co., Inc., Saugus, Mass.
Foster, Theodore W., & Bro. Co., Providence, R. I.
General Mach. & Mfg. Co., Bridgeport, Ct.
Geuder, Paeschke & Frey Co., Milwaukee.
Gibson, Wm. D., Co., Chicago.
Globe Mch. & Stpg. Co., Cleveland.
Hubbard, M. D., Spring Co., Pontiac, Mich.
Lansing (Mich.) Stamping Co., So. Penn Ave.
Lee Spring Co., Inc., 30 Main St., Brooklyn, N. Y.
Miller & Van Winkle, Inc., 18 Bridge St., Brooklyn, N. Y.
Parish Pressed Steel Co., Reading, Pa.
Raymond Mfg. Co., Corry, Pa.
Smith, Thomas, Co., 286 Grove St., Worcester, Mass.
Torrington (Ct.) Co.
Truscon Steel Co., Pressed Steel Div., Cleveland.
Veeder-Root, Inc., Hartford, Ct.
Wiley & Lett, Inc., Marion, Ind.
Worcester (Mass.) Stamped Metal Co.

STAMPS—Steel Alphabets and Figures
Noble & Westbrook Mfg. Co., Hartford, Ct.

STAPLES—Wire
Titchener, E. H., & Co., Binghamton, N. Y.
Wickwire Brothers, Cortland, N. Y.

STEEL—Alloy
Alan Wood Steel Co., Conshohocken, Pa.
American Steel & Wire Co., Chicago.
Andrews Steel Co., The, Newport, Ky.
Bethlehem (Pa.) Steel Company.
Bissett Steel Co., The, Cleveland.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Detroit (Mich.) Alloy Steel Co.
Harrisburg (Pa.) Pipe & Pipe Bending Co.
Ingersoll Steel & Disc Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL—Alloy, Cold Drawn
Moltrup Steel Products Co., Beaver Falls, Pa.
Union Drawn Steel Co., Massillon, Ohio.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.
Wyckoff Drawn Steel Co., Ambridge, Pa.

STEEL—Bright Finished
Union Drawn Steel Co., Massillon, Ohio.

STEEL—Carbon
Andrews Steel Co., The, Newport, Ky.
Carnegie Steel Co., Pittsburgh.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Harrisburg (Pa.) Pipe & Pipe Bending Co.
Ingersoll Steel & Disc Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Lukenweld, Inc., Coatesville, Pa.

STEEL—Carbon Vanadium
Andrews Steel Co., The, Newport, Ky.
Latrobe (Pa.) Electric Steel Co.

STEEL—Chrome
American Steel & Wire Co., Chicago.
Andrews Steel Co., The, Newport, Ky.
Latrobe (Pa.) Electric Steel Co.

STEEL—Chrome Manganese
Latrobe (Pa.) Electric Steel Co.

STEEL—Chrome Nickel
American Steel & Wire Co., Chicago.
Andrews Steel Co., The, Newport, Ky.
Harrisburg (Pa.) Pipe & Pipe Bending Co.
Latrobe (Pa.) Electric Steel Co.

STEEL—Chrome Nickel Silver
Ingersoll Steel & Disc Co., Chicago

Products Index

STEEL—Chrome Nickel Stainless
Allegheny Steel Co., Brackenridge, Pa.

STEEL—Chrome Stainless
Allegheny Steel Co., Brackenridge, Pa.

STEEL—Chrome Vanadium
Andrews Steel Co., The, Newport, Ky.
Harrisburg (Pa.) Pipe & Pipe Bending Co.
Latrobe (Pa.) Electric Steel Co.

STEEL—Cold Drawn
American Steel & Wire Co., Chicago.
Bliss & Laughlin, Inc., Harvey, Ill.
Jones & Laughlin Steel Corp., Pittsburgh.
Moltrup Steel Products Co., Beaver Falls, Pa.
Latrobe (Pa.) Electric Steel Co.
Rathbone, A. B. & J., Palmer, Mass.
Ryerson, Joseph T., & Son, Inc., Chicago.
Union Drawn Steel Co., Massillon, Ohio.
Wyckoff Drawn Steel Co., Ambridge, Pa.

STEEL—Cold Rolled Strips
Acme Steel Co., Chicago.
American Steel & Wire Co., Chicago.
Athenia Steel Co., 135 William St., N. Y.
Griffin Mfg. Co., Erie, Pa.
Inland Steel Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Stanley Works, The, New Britain, Conn.
Steel & Tubes, Inc., Cleveland.
Superior Steel Corp., Grant Bldg., Pgh.
Thomas Steel Co., Warren, Ohio.
Weirton (W. Va.) Steel Co.
West Leechburg Steel Co., Pittsburgh.
Wetherell Bros. Co., Cambridge, 39, Mass.

STEEL—Cold Rolled Strips, Chrome Nickel
Acme Steel Co., Chicago.
Griffin Mfg Co., Erie, Pa.

STEEL—Cold Rolled Strips, Electric Copper Coated
Thomas Steel Co., Warren, Ohio.

STEEL—Cold Rolled Strips, Electro-Galvanized
Thomas Steel Co., Warren, Ohio.

STEEL—Cold Rolled Strips, Electro Tin Coated
Thomas Steel Co., Warren, O.

STEEL—Corrosion Resisting
American Steel & Wire Co., Chicago.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Midvale Co., The, Nicetown, Phila., Pa.

STEEL—Crucible
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL—Cutlery
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.

STEEL—Die
Andrews Steel Co., The, Newport, Ky.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.

STEEL—Drill
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.

STEEL—Electric
Inland Steel Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL—High Speed
Bethlehem (Pa.) Steel Company.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Ingersoll Steel & Disc Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Vanadium-Alloys Steel Co., Latrobe, Pa.

STEEL—Hot Rolled Strips
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.
Laclede Steel Co., St. Louis, Mo.
Latrobe (Pa.) Electric Steel Co.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Stanley Works, The, New Britain, Ct.
Steel & Tubes, Inc., Cleveland.
Superior Steel Corp., Grant Bldg., Pgh.
Weirton (W. Va.) Steel Co.
West Leechburg Steel Co., Pittsburgh.

STEEL—Hot Rolled Strips, Electro Zinc Coated
Thomas Steel Co., Warren, O.

STEEL—Magnet
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Latrobe (Pa.) Electric Steel Co.

STEEL—Manganese Rolled
Lukenweld, Inc., Coatesville, Pa.

STEEL—Nickel
Andrews Steel Co., The, Newport, Ky.

STEEL—Open Hearth
Andrews Steel Co., The, Newport, Ky.
Pittsburgh (Pa.) Steel Co.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.

STEEL—Rustless
Allegheny Steel Co., Brackenridge, Pa.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Griffin Mfg. Co., Erie, Pa.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.

STEEL—Screw
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.
Union Drawn Steel Co., Massillon, Ohio.
Wyckoff Drawn Steel Co., Ambridge, Pa.

STEEL—Special Analysis
Andrews Steel Co., The, Newport, Ky.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Harrisburgh (Pa.) Pipe & Pipe Bending Co.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Republic Steel Corp., Youngstown, Ohio.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.
West Leechburg Steel Co., Pittsburgh.

STEEL—Spring
Athenia Steel Co., 135 William St., N. Y.
Barnes-Gibson-Raymond, Inc., Detroit.
Barnes, Wallace, Co., The, Bristol, Conn.
Gibson, Wm. D., Co., Chicago.
Republic Steel Corp., Youngstown, Ohio.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.

STEEL—Stainless
Allegheny Steel Co., Brackenridge, Pa.
American Steel & Wire Co., Chicago.
Bethlehem (Pa.) Steel Company.
Carnegie Steel Co., Pittsburgh.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Illinois Steel Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Midvale Co., The, Nicetown, Phila., Pa.
Republic Steel Corp., Youngstown, Ohio.
Ryerson, Jos. T., & Son, Inc., Chicago.
Union Drawn Steel Co., Massillon, Ohio.
Wetherell Bros. Co., Cambridge, 39, Mass.

STEEL—Stainless Clad
Ingersoll Steel & Disc Co., Chicago.

STEEL—Tool
Bethlehem (Pa.) Steel Company.
Bisset Steel Co., The, Cleveland.
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Detroit (Mich.) Alloy Steel Co.
Ingersoll Steel & Disc Co., Chicago.
Latrobe (Pa.) Electric Steel Co.
Ludlum Steel Co., Watervliet, N. Y.
Midvale Co., The, Nicetown, Phila., Pa.
Ryerson, Jos. T., & Son, Inc., Chicago.
Vanadium-Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

STEEL—Tool—Cast
Detroit (Mich.) Alloy Steel Co.

STEEL—Tool, Special Shapes
Latrobe (Pa.) Electric Co.

STEEL—Vanadium
Andrews Steel Co., The, Newport, Ky.
Latrobe (Pa.) Electric Steel Co.

STEEL CONSTRUCTION—Welded (Machine Frames, Parts, Etc.)
Lukenweld, Inc., Coatesville, Pa.

STEEL PLANTS AND ROLLING MILLS
Perin Engineering Co., Inc., 11 West 42nd St., N. Y. C.

STEEL PLATE CONSTRUCTION
Graver Tank & Mfg. Corp., East Chicago, Ind.
McClintic-Marshall Corp., Bethlehem, Pa.

STEPS—Ladder and Stairs, Safety
Central Iron & Steel Co., Harrisburg, Pa.

STOCKS AND DIES
Jones & Lamson Mch. Co., Springfield, Vt.

STOKERS
Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

STOPS—Crane Limit
Electric Controller & Mfg. Co., Cleveland.

STRAIGHTENING MACHINES—Wire
Lewis Mch. Co., The, Cleveland, Ohio.

STRUCTURAL IRON AND STEEL WORK
American Bridge Co., Pittsburgh.
McClintic-Marshall Corp., Bethlehem, Pa.
Morgan Engineering Co., Alliance, Ohio.

STRUCTURAL STEEL — See Angles, Beams, Channels and Tees

SUPERHEATERS
Babcock & Wilcox Co., The, 85 Liberty St., N. Y. C.

SWAGING MACHINES
Quickwork Co., The, St. Marys, Ohio.
Torrington (Ct.) Co.

SWITCHES—Electric
Westinghouse Elec. & Mfg. Co., East Pgh.

TACHOMETERS—Angular and Linear Velocity
Barbour-Stockwell Co., Cambridge, Mass.

TANK LININGS—Rubber
American Hard Rubber Co., 11 Mercer St., N. Y. C.
Goodrich, B. F., Rubber Co., Akron, Ohio.

TANKS—Compressed Air, Gas, Oil and Water
Graver Tank & Mfg. Corp., East Chicago, Ind.
Scaife, Wm. B., & Sons Co., Ptgh.
Westinghouse Traction Brake Co., Industrial Div., Pittsburgh.

TANKS—Elevated Steel
McClintic-Marshall Corp., Bethlehem, Pa.

TANKS—Elevated Wood
Hauser-Stander Tank Co., Cincinnati, Ohio.

TANKS—Elevated Steel
Graver Tank & Mfg. Corp., East Chicago, Ind.

TANKS—Gasoline and Oil
Graver Tank & Mfg. Corp., East Chicago, Ind.

TANKS—Iron and Steel
McClintic-Marshall Corp., Bethlehem, Pa.
Scaife, Wm. B., & Sons Co., Ptgh.

TANKS—Lead Lined
Hauser-Stander Tank Co., Cincinnati, Ohio.

TANKS—Pickling
American Hard Rubber Co., 11 Mercer St., N. Y. C.
Hauser-Stander Tank Co., Cincinnati, Ohio.
Nukem Prods. Corp., 68 Niagara St., Buffalo, N. Y.

TANKS—Rubber Lined
American Hard Rubber Co., 11 Mercer St., N. Y. C.
Hauser-Stander Tank Co., Cincinnati, Ohio.

TANKS—Seamless Steel
National Tube Co., Pittsburgh.

TANKS—Water
Hauser-Stander Tank Co., Cincinnati, Ohio.

TANKS—Welded
National Tube Co., Pittsburgh.
Scaife, Wm. B., & Sons Co., Pittsburgh.

Products Index

TANKS—Wood
Hauser-Stander Tank Co., Cincinnati, Ohio.

TAPPING MACHINES—Nuts
National Mchry. Co., Tiffin, Ohio.

TAPS—Collapsing
Landis Mach. Co., Inc., Waynesboro, Pa.

TAPS AND DIES
Landis Mch. Co., Inc., Waynesboro, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

TAR DISTILLING PLANTS
Koppers Construction Co., The, Pittsburgh.

TEES—See Angles, Beams, Channels and Tees

TELEPHONES—Interior
Screw Machine Products Corp., Prov., R. I.

TERNE PLATES
American Sheet & Tin Plate Co., Ptgh.

TERNE PLATES—Copper Bearing
Weirton (W. Va.) Steel Co.

TESTING MACHINES—Materials
Baldwin-Southwark Corp., Southwark Div., Philadelphia.

THERMOSTATIC METAL
Chace, W. M., Valve Co., Detroit, Mich.

THREAD CUTTING TOOLS—See Dies, Taps.

THREAD ROLLING MACHINES
Nilson, A. H., Mach. Co., Bridgeport, Ct.

THREADING MACHINES
Landis Mch. Co., Waynesboro, Pa.
National Mchry. Co., Tiffin, Ohio.

THREADING MACHINES—Automatic
Landis Mch. Co., Inc., Waynesboro, Pa.

TIE PLATES
Illinois Steel Co., Chicago.
Inland Steel Co., Chicago.
Weirton (W. Va.) Steel Co.

TIES—BALE
American Steel & Wire Co., Chicago.
American Sheet & Tin Plate Co., Ptgh.

TIN PLATE
Granite City (Ill.) Steel Co.
Jones & Laughlin Steel Corp., Pittsburgh.
Republic Steel Corp., Youngstown, O.
Weirton (W. Va.) Steel Co.
Youngstown (Ohio) Sheet & Tube Co.

TIN PLATE MACHINERY
Wean Engineering Co., Inc., The Warren, Ohio.

TINNING EQUIPMENT—Sheets
Wean Engineering Co., Inc., The, Warren, Ohio.

TOOL BITS
Carpenter Steel Co., 121 W. Bern St., Reading, Pa.
Haynes Stellite Co., 30 East 42nd St., N. Y. C.

TOOL HOLDERS
Armstrong Bros. Tool Co., Chicago.

TOOLS—Lathe
Armstrong Bros. Tool Co., Chicago.

TOOLS—Metal Cutting
Haynes Stellite Co., 30 East 42nd St., N. Y. C.

TOOLS—Welded Tip
Haynes Stellite Co., 30 East 42nd St., N. Y. C.

TORCHES—Brazing, Cutting and Welding
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

TOWERS, Steel
McClintic-Marshall Corp., Bethlehem, Pa.

TOWERS—Transmission
McClintic-Marshall Corp., Bethlehem, Pa.

TRACTORS AND TRAILERS—See Trucks, Tractors and Trailers—Industrial

TRAILERS—Industrial—See Trucks, Tractors and Trailers—Industrial

TRAMRAILS—Overhead Systems
Cleveland Electric Tramrail, Wickliffe, O.

TRAMWAYS—Wire Rope
American Steel & Wire Co., Chicago.
Leschen, A., & Sons Rope Co., St. Louis, Mo.

TRUCKS, TRACTORS AND TRAILERS—Industrial
Atlas Car & Mfg. Co., Cleveland.

TUBES—Boiler
Allegheny Steel Co., Brackenridge, Pa.
National Tube Co., Pittsburgh.
Pittsburgh (Pa.) Steel Co.

TUBES—High Carbon
Steel & Tubes, Inc., Cleveland.

TUBES—Stainless Steel
Allegheny Steel Co., Brackenridge, Pa.

TUBING—Flexible Metallic
Bissett Steel Co., The, Cleveland.

TUBING—Genuine Wrought Iron
Byers, A. M., Co., Pittsburgh.

TUBING—Hard Rubber
American Hard Rubber Co., 11 Mercer St., N. Y. C.

TUBING—Magnesium Alloys
Dow Chemical Co., Midland, Mich.

TUBING—Nichrome
Steel & Tubes, Inc., Cleveland.

TUBING—Open Seam
Steel & Tubes, Inc., Cleveland.

TUBING—Phosphor Bronze
Phosphor Bronze Smelting Co., Philadelphia.

TUBING—Rubber
Goodrich, B. F., Rubber Co., Akron, O.

TUBING—Seamless Steel
Allegheny Steel Co., Brackenridge, Pa.
National Tube Co., Pittsburgh.
Pittsburgh (Pa.) Steel Co.
Steel & Tubes, Inc., Cleveland.
Timken Roller Bearing Co., Canton, Ohio.
Timken Steel & Tube Co., The, Canton, O.
Youngstown (Ohio) Sheet & Tube Co.

TUBING—Square and Rectangular
National Tube Co., Pittsburgh.
Steel & Tubes, Inc., Cleveland.

TUBING—Stainless Steel
Steel & Tubes, Inc., Cleveland.

TUBING—Tool Steel
Bissett Steel Co., The, Cleveland.

TUBING—Welded Steel
National Tube Co., Pittsburgh.
Steel & Tubes, Inc., Cleveland.
Youngstown (Ohio) Sheet & Tube Co.

TUBULAR PRODUCTS
Steel & Tubes, Inc., Cleveland.

TUMBLING BARRELS — See Barrels — Tumbling

TURNTABLES
American Bridge Co., Pittsburgh.

TWIST DRILLS
Cleveland (Ohio) Twist Drill Co.
Morse Twist Drill & Mch. Co., New Bedford, Mass.

TYPE—Steel
Noble & Westbrook Mfg. Co., Hartford, Ct.

UNIONS
Dart, E. M., Mfg. Co., Prov., R. I.

VALVE DISCS
Garlock Packing Co., The, Palmyra, N. Y.

VALVES—Air Operating
Westinghouse Traction Brake Co., Industrial Div., Pittsburgh.

VALVES—Gas, Water and Steam
Jarecki Mfg. Co., Erie, Pa.
Wood, R. D., & Co., Philadelphia.

VALVES—Hydraulic
Baldwin-Southwark Corp., Southwark Div., Philadelphia.
Wood, R. D., & Co., Philadelphia.

Products Index

VALVES—Pump, Rubber
Garlock Packing Co., The, Palmyra, N. Y.

VISES
Jarecki Mfg. Co., Erie, Pa.

WASHERS—Iron or Steel
Central Iron & Steel Co., Harrisburg, Pa.
Smith, Thomas, Co., 286 Grove St., Worcester, Mass.

WATER SOFTENERS AND PURIFIERS
Scaife, Wm. B., & Sons Co., Ptgh.

WELDING—Electric
Lukenweld, Inc., Coatesville, Pa.
Westinghouse Elec. & Mfg. Co., East Ptgh.

WELDING—Thermic
Metal & Thermit Corp., 120 B'way, N. Y. C.

WELDING AND CUTTING MACHINES AND EQUIPMENT—Oxy-Acetylene
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
Linde Air Prods. Co., The, 30 East 42nd St., N. Y. C.

WELDING MACHINES—Electric Arc
General Electric Co., Schenectady, N. Y.
Harnischfeger Corp., 1401 W. National Ave., Milwaukee, Wis.
Lincoln Electric Co., Cleveland.
Westinghouse Elec. & Mfg. Co., East Ptgh.
Wilson Welder & Metals Co., Inc., North Bergen, N. J.

WELDING MACHINES — (Electric Arc) Second Hand
Goodman Elec. Mchry. Co., Newark, N. J.

WELDING MACHINES—Spot
Eisler Electric Corp., 765 So. 13th St., Newark, N. J.

WHEELS—Rolled Steel
Carnegie Steel Co., Pittsburgh.
Illinois Steel Co., Chicago.

WIRE—Barb
Jones & Laughlin Steel Corp., Pittsburgh.
Pittsburgh (Pa.) Steel Co.

WIRE—Brass, Bronze, Copper, Nickel, Silver or Phosphor Bronze
Michigan Wire Cloth Co., 2117 Howard St., Detroit.
Phosphor Bronze Smelting Co., Philadelphia.
Seymour (Conn.) Mfg. Co.

WIRE—Electric Heat Resisting
Globar Corp., Niagara Falls, N. Y.

WIRE—Flat, Round, Square or Special Shapes
American Steel & Wire Co., Chicago.
Barnes, Wallace, Co., The, Bristol, Conn.
Page Steel & Wire Co., Monessen, Pa.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio.
Webb Wire Works, New Brunswick, N. J.
Wickwire Bros., Cortland, N. Y.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

WIRE—Insulated
American Steel & Wire Co., Chicago.
Roebling's, John A., Sons Co., Trenton, N.J.

WIRE—Mattress
American Steel & Wire Co., Chicago.
Roebling's, John A., Sons Co., Trenton, N.J.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio.

WIRE—Netting
Roebling's, John A., Sons Co., Trenton, N.J.
Wickwire Brothers, Cortland, N. Y.

WIRE—Piano and Music
Webb Wire Works, New Brunswick, N. J.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

WIRE—Special, Drawn Shapes
Rathbone, A. B. & J., Palmer, Mass.

WIRE—Spoke and Crimping
Seneca Wire & Mfg. Co., The, Fostoria, Ohio.

WIRE—Spring
American Steel & Wire Co., Chicago.
Barnes, Wallace, Co., The, Bristol, Conn.
Johnson Steel & Wire Co., Inc., Worcester, Mass.
Jones & Laughlin Steel Corp., Pittsburgh.
Pittsburgh (Pa.) Steel Co.
Roebling's, John A., Sons Co., Trenton, N.J.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio.

WIRE—Stainless Steel
Page Steel & Wire Co., Monessen, Pa.

WIRE—Steel
Wickwire Brothers, Cortland, N. Y.

WIRE—Welding
Air Reduction Sales Co., 60 East 42nd St., N. Y. C.
American Steel & Wire Co., Chicago
Lincoln Electric Co., Cleveland.
Metal & Thermit Corp., 120 B'way, N. Y. C.
Page Steel & Wire Co., Monessen, Pa.
Pittsburgh (Pa.) Steel Co.
Roebling's, John A., Sons Co., Trenton, N. J.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio.
Wickwire Brothers, Cortland, N. Y.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.
Wilson Welder & Metals Co., Inc., North Bergen, N. J.

WIRE CLOTH
Michigan Wire Cloth Co., 2117 Howard St., Detroit, Mich.
Roebling's, John A., Sons Co., Trenton, N.J.
Seneca Wire & Mfg. Co., The, Fostoria, Ohio.
Wickwire Bros., Cortland, N. Y.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

WIRE DRAWING MACHINERY — See Wire Mill Machinery and Equipment

WIRE FORMING MACHINERY
Baird Machi Co., Bridgeport, Conn.
Nilson, A. H., Mach. Co., Bridgeport, Ct.

WIRE NAIL MACHINERY
National Mchry. Co., Tiffin, Ohio.

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American Steel & Wire Co., Chicago.
Cuyahoga Spring Co., Cleveland.
Eastern Tool & Mfg. Co., Bloomfield, N. J.
Hindley Mfg. Co., Valley Falls, R. I.
Pittsburgh (Pa.) Steel Co.
Titchener, E. H., & Co., Binghamton, N. Y.
Wickwire Bros., Cortland, N. Y.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

WIRE ROPE
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Leschen, A., & Sons Rope Co., St. Louis, Mo.
Roebling's, John A., Sons Co., Trenton, N.J.
Wickwire Spencer Steel Co., 41 East 42nd St., N. Y. C.

WIRE ROPE FITTINGS
American Steel & Wire Co., Chicago.
Roebling's John A., Sons Co., Trenton, N. J.

WIRE STRAIGHTENING AND CUTTING MACHINERY—Automatic
Franklin Mfg. Co., New Haven, Conn.
Lewis Mch. Co., The, Cleveland, Ohio.
Shuster, F. B., New Haven, Ct.

ZINC—Slab (Spelter)
New Jersey Zinc Co., Inc., The, 160 Front St., N. Y. C.
United Metals Selling Co., 25 Broadway, N. Y. C.

"It pays to use your advertising pages"

PARTIAL LIST

10' Betts Vertical Boring Mill, power rapid traverse, geared feeds, motor drive.
36" Bullard New Era Vertical Turret Lathe, motor bracket, thread cutting attachment, cutting lubricant systems.
No. 31 Lucas Horizontal Boring Mill, MD.
6' American Plain Radial Drill, MD.
No. 1 Hoosier Heavy Duty Drill, MD.
4' Fosdick Plain Radial Drill, MD.
No. 2 Cincinnati Centerless Grinder, MD.
16" x 72" Landis Crank Shaft Grinder, MD.
14" x 8' Hendey Tool Room Lathe, TA.
20" x 10' American Geared Head Lathe, MD.
24" x 16' American Geared Head Lathe, MD.
30" x 20' American Geared Head Lathe, MD.
18" Cincinnati Manufacturing Type Millers.
No. 2 Rockford Universal Milling Machine.
30-ton Lucas Power Forcing Press.
No. 404 Loy & Nawrath Vertical Press Brake Motor Drive.
48" x 48" x 26' Cincinnati Planer, 4-heads M.D. through gear box.
10' Ohl Power Squaring Shear.
16" Gould & Eberhardt Shaper, gear box, MD.
No. 3 Mitts & Merrill Keyseater, power feed to cutter bar.
No. 2 Garvin Automatic Tapping Machine.

SEND FOR COMPLETE LIST

IROQUOIS MACHINERY COMPANY
656 OHIO ST. BUFFALO N.Y.

TELEPHONE: CLEVELAND 302

IROQUOIS MACHINERY COMPANY
MACHINE TOOLS
658 OHIO STREET BUFFALO, N. Y.

September 27, 1933

Mr. B. L. Herman,
Buffalo Manager,
The Iron Age,
675 Delaware Ave.,
Buffalo, N. Y.

Dear Mr. Herman:

When we started in business, one of the first things we did was to place an advertisement in your Clearing House Section. It is still running.

Our experience enables us to say very definitely that it pays to use your advertising pages.

In fact, we consider The Iron Age our most important medium. As you know, we have the largest stock of high grade used tools in this section of the country, and, of course, it is important to keep prospective buyers informed of leading specials. We know of no better way of doing this than by keeping an advertisement running in The Iron Age.

With cordial, good wishes,

we are

Very truly yours,
IROQUOIS MACHINERY CO.
B. Symmonds M.T.
General Manager.

To dispose of used machinery and equipment use Iron Age Clearing House Section... famous for years for ACTION and RESULTS

• THE CLEARING HOUSE •

Late Model Lathes

2—14′ x 6′ MONARCH "AA":
Timkenized Spindle; Helical geared; AC motor-in-leg drive. One with taper. Both with chucks. Like new.

1—16′ x 8′ AMERICAN:
Geared head; twelve speed; AC motor-in-leg, chuck.

You should see these fine tools.

LUCAS & SON, INC.
Bridgeport, Conn.

Desirable Equipment:

PUTNAM 72″ x 40′ Lathe, Triple Geared, Internal Face Plate, Cone Driven, 6 inch Belt.
LODGE & SHIPLEY 48″ x 18′ Lathe, Triple Geared, Internal Face Plate, Cone Driven, 4½ inch belt.
OHIO Planer 36″ x 36″ x 10′, Two heads on Rail, Belt Drive, Never used.
ABRASIVE Grinder No. 33, 3 phase Motor in Base.
INGERSOLL Miller, Vertical Spindle, Planer Type, 36″ x 8′ Table.
BROWN & SHARPE No. 5 Vertical Spindle Miller.
HENRY & WRIGHT Die Press, 10 Ton.
BROWN & SHARPE No. 10 Cylindrical Grinder, Self-contained.

Other Tools Just as Desirable.

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99 Chestnut St., Newark, N. J.

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No. 25U Buffalo universal
10′ x 14 ga. Kutscheid squaring
36″ & 42″ Niagara foot squaring
¼″, No. 3 Lennox serpentine
30″ & 60″ Pettingell 14 ga. rotary

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Nos. 64, 65 & 67 Consolidated S.S.
No. 74½ Bliss straight side
No. 6 Adriance O.B.I.
No. 165 Toledo toggle drawing
150 ton Ferracute embossing

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30″ x 30″ x 8′ Cleveland openside
30″ x 30″ x 12′ Cleveland openside
26″ Lynd Farquhar crank openside
36″ x 36″ x 12′ Cleveland openside
72″ x 60″ x 14′ Cleveland openside

SHAPERS

14″ & 20″ Steptoe
15″ & 24″ Potter & Johnston
16″ & 20″ Milwaukee
20″ & 24″ Gould & Eberhardt
28″ Columbia Heavy Duty

LATHES

48″ x 16′ American geared head
26″ x 14′ Putnam
20″ x 8′ Lodge & Shipley
17″ x 8′ Leblond heavy duty
16″ x 8′ Lodge & Shipley

PARTIAL LIST ONLY
1500 TOOLS IN STOCK

MILES
MACHINERY COMPANY
SAGINAW, W.S.
MICHIGAN

PARTIAL LIST

10′ Betts Vertical Boring Mill, power rapid traverse, geared feeds, motor drive.
36″ Bullard New Era Vertical Turret Lathe, motor bracket, thread cutting attachment, cutting lubricant systems.
3½″ Bar Universal Horizontal Boring Mill, gear box, single pulley drive.
3′ American High Speed Sensitive Radial Drill, tapping attachment.
No. 2 Cincinnati Centerless Grinder, M.D.
16″ x 72″ Landis Crank Shaft Grinder, M.D.
No. 12 LeBlond Heavy Multi-Cut Lathes, M.D.
14″ x 8′ Hendey Tool Room Lathe, TA.
24″ x 16′ American Geared Head Lathe, M.D.
18″ Cincinnati Manufacturing Type Millers.
No. 2 Rockford Universal Milling Machine.
30-ton Lucas Power Forcing Press.
No. 404 Loy & Nawrath Vertical Press Brake Motor Drive.
48″ x 48″ x 26′ Cincinnati Planer, 4-heads MD. through gear box.
10′ Ohl Power Squaring Shear.
No. 14 Cochrane-Bly Universal Shaper, SPD.
No. 3 Mitts & Merrill Keyseater, power feed to cutter bar.
No. 2 Garvin Automatic Tapping Machine.

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MACHINERY COMPANY
656 OHIO ST. BUFFALO, N.Y.

NEW YORK, N. Y.
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1—DILL 15/18″ Slotter
1000 other high grade machines all attractively priced. Send us your inquiry.

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10″ x 18″ NORTON Type B A Plain Grinder. Self-contained A.C. 3-phase Motor Drive, Generator, etc. Practically New. Original Cost over $5000.00. PRICE: $1950.00.

MORRIS MACHINERY CO.
NEWARK, N. J.

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1—10′6″ Hilles & Jones Bending Roll
1—84″ Bliss Straight Side Press 450 tons pressure
1—250 ton Wood Sectional Flanger
1—500 ton United Forging Press
1—10′6″ Loy & Nawrath Press Brake 3/16″ capacity
1—30′ Draw Bench 20,000 lb. capacity
1—60″x38′ Bridgeford Geared Head Lathe
1—36″ Bullard New Era Type
1—Espen Lucas Column Facer

SEVERIN MACHINERY CO.
30 Church St., New York City

No. 1½-B Milwaukee Vertical Miller

Power feed rotary table
Price $1050.00 Like New

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60″ x 50′ N-B-POND HEAVY DUTY MOTOR D.
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56″ x 18′ N-B-POND HEAVY DUTY MOTOR D.
50″ x 34′ PITTSBURGH TRIPLE GEARED M.D.
42″ x 28′ N-B-POND DOUBLE CARRIAGE M.D.
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30″ x 22′ AMERICAN HEAVY DUTY GD. HD.
24″ x 20′ AMERICAN HEAVY DUTY GD. HD.
24″ x 20′ L & SHIPLEY GEARED HD. M.D.
24″ x 18′ L & SHIPLEY GEARED HD. M.D.
24″ x 10′ AMERICAN GEARED HD. MOTOR D.
24″ x 10′ L AND SHIPLEY GEARED HD. M.D.
18″ x 12′ L AND SHIPLEY GEARED HD. M.D.
16″ x 10′ P AND WHITNEY GEARED HD. M.D.

Ask for Complete List. 2000 Mchs. in Stock.

SIMMONS MACHINE TOOL CORP.
Albany Jersey City New York

13′ Ohl Brake.
10′ Ohl Brake (Incl. motor).
Ferracute No. 87 Power Double Crank, Punching, Shearing or Stamping Press
and
Approximately 40,000 lb. cold rolled galvanized shapes.

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NEW MACHINES AT USED PRICES

3—Quadruple All Steel Comb. Punches and Shears, two with cap. to punch ¾″ thru ⅞″, shear 4 x 4 x ⅝″ angles; one with cap. to punch 1″ thru 1″, shear 5 x 5 x ½″ angles.
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Straightening Rolls, 4′ x 5/16″.

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Bolt and Rivet Headers; Trimmers; Thread Rollers; Cold and Hot Nut Machines; Bent and Vertical Tappers; Slotters; Bolt and Pipe Threaders.

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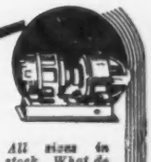

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The following sizes in stock:
55″, 43″, 36″, 24″, 18″
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A.C. MOTORS—3 Phase, 60 Cycle

H.P.	Make	Volts	Type	Speed
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1—600	G. E.	440/220	TS-Synch.	360
1—400	G. E.	440	IM-Slip Ring	505
1—400	West.	2200/550	CW-Slip Ring	450
1—300	Al. Ch.	2200	ANY-Slip Ring	585
1—220	G. E.	550	ATI-Synch.	900
2—200	G. E.	4000/2200	ATI-Synch.	514
1—200	West.	220/440	CS-Sq. Cage	580
1—200	West.	440/220	CW-Slip Ring	500
1—200	F. Mor.	440/220	BV-Slip Ring	600
1—200	Cr. Wh.	440	Q-Slip Ring	875
1—125	Cr. Wh.	220/440	Synch.	900
1—100	Cr. Wh.	220/440	Synch.	225
2—100	West.	220	CS-Sq. Cage	720

Large Stock of FULLY GUARANTEED a.c. and d.c. MOTORS—GENERATORS—TRANSFORMERS and ELECTRICAL EQUIPMENT

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1—5-ton Shaw, 3 motor 48'-0" span, floor or cage controlled, 220 v., D.C.
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1—10-ton Niles and Shaw, 3-motor, 50'-0" span, cage controlled, 220-440 v., 3 ph., 60 cy.
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Send me your crane and hoist inquiries
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2—20 ton Vulcan Gasoline, built 1929.
3—40 ton American S.T., built 1928.
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42—12 yd. Western Air or Hand Dump.
26—50 ton 40 ft. Steel Gondolas.
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We buy rails fit to relay.
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If it is in good condition the chances are someone else can use it.

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WANTED

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477 St. Paul St. Rochester, N. Y.

WANTED TO BUY
The following second - hand Brown & Sharpe Machines:
One #2 Automatic Screw Machine
One #2 Automatic Turret Forming Machine
H. M. QUACKENBUSH
Herkimer, N. Y.

WANTED
600 ton MECHANICAL PRESS
60 in. gap for bending plates. 10 ft. wide.
ADDRESS BOX A-878
care *The Iron Age*, Park Bldg., Pittsburgh, Pa.

Cold Bolt Headers and Trimmers, Automatic Thread Rollers, Modern Cut-Off Machine, Vaughn Wire Drawing Bull Block.
DONAHUE STEEL PRODUCTS CO.
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